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THE BELGIAN SYSTEM OF CANAL TOWING.

There are now navigating the canals of this State over five thousand boats, which are kept in motion by either steam or animal power; by far the greater proportion are propelled by animals. Whether the power is economically applied or not is a matter of great importance, as the quantity of freight that is moved on these artificial waters is immense.

The reward offered by the State in 1871, for an economical system of canal propulsion, has been the means of directing the attention of inventors to this subject, and improvements of more or less merit have been developed; but the hoped-for new system, if we may judge from the continued employment of animals, has not been adopted if it really exists.

The Belgian system itself is not new, it having been employed in Europe for more than 18 years, and long before that, boats were hauled by means of submerged chains. The modern improvements, which render the system and machinery complete, consist in the substitution of wire rope for the ponderous and more expensive chain, and a clip drum or driving wheel for the ordinary indented windlass. This system has been adopted by the New York Steam Cable Towing Company, who have for several years towed boats on this plan from Buffalo, N. Y, to Lockport, proving not only the economy of the system, but its perfect adaptability to canals, and especially to the Erie Canal. Meantime they have perfected the mechanism of their boats. The State has granted to them 50 years' exclusive privilege of laying cables in the Erie Canal between Buffalo and Albany for this purpose, and the cables will be laid as far as Rochester this season.

Two cables will be laid, one for the up boats and the other for the down. The cables, which are one inch in diameter, are made of steel wire, and have a hemp core. They weigh 4 tons to the mile, and have no slack.

The tow boat, which is shown in Fig. 2, is 78 feet 6 inches long, 16 feet broad, and draws, when loaded with coal, 5 feet of water. It has a rudder at each end, the one at the bow being always locked, as in the case of our New York ferry boats. The boat carries a screw at one end, 4 feet in diameter and 7 feet pitch, which is used merely to propel the boat through the locks. Upon one side of the boat are three wheels, each 6 feet in diameter, the center one, as shown in Fig. 3, carrying around its periphery clips, which grasp the cable tightly as it passes over the top of the wheel. This wheel is secured to a 6 inch shaft, which is about on a level with the deck; the shaft receives its power from the engine shaft through a train of gearing which causes it to make about one revolution to eight of the engine. The wheels at the sides of the clip wheel are simply tighteners, to hold the cable down to the clip wheel. They are supported on studs projecting from blocks which slide in the inclined ways, and are moved by screws passing through the blocks. The cable is taken up by two sheaves, like that shown in Fig. 4, placed one near each end, as shown in Fig. 2.

The engine is an inverted vertical of the plain, substantial style usually built at the Pound Mfg. Co.'s Works in Lock-

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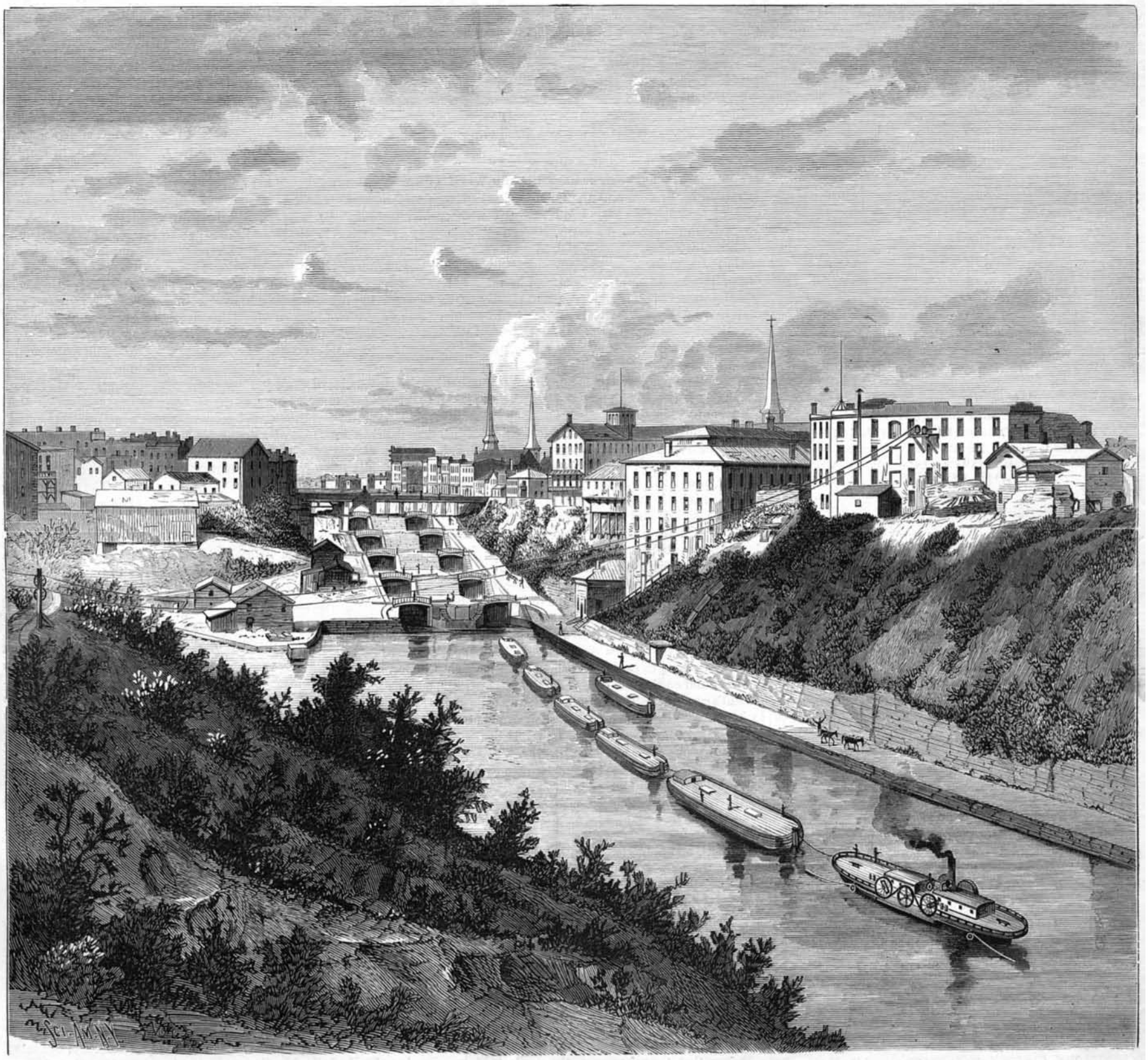

THE BELGIAN SYSTEM OF CABLE TOWING.—THE LOCKS AT LOCKPORT, N. Y.

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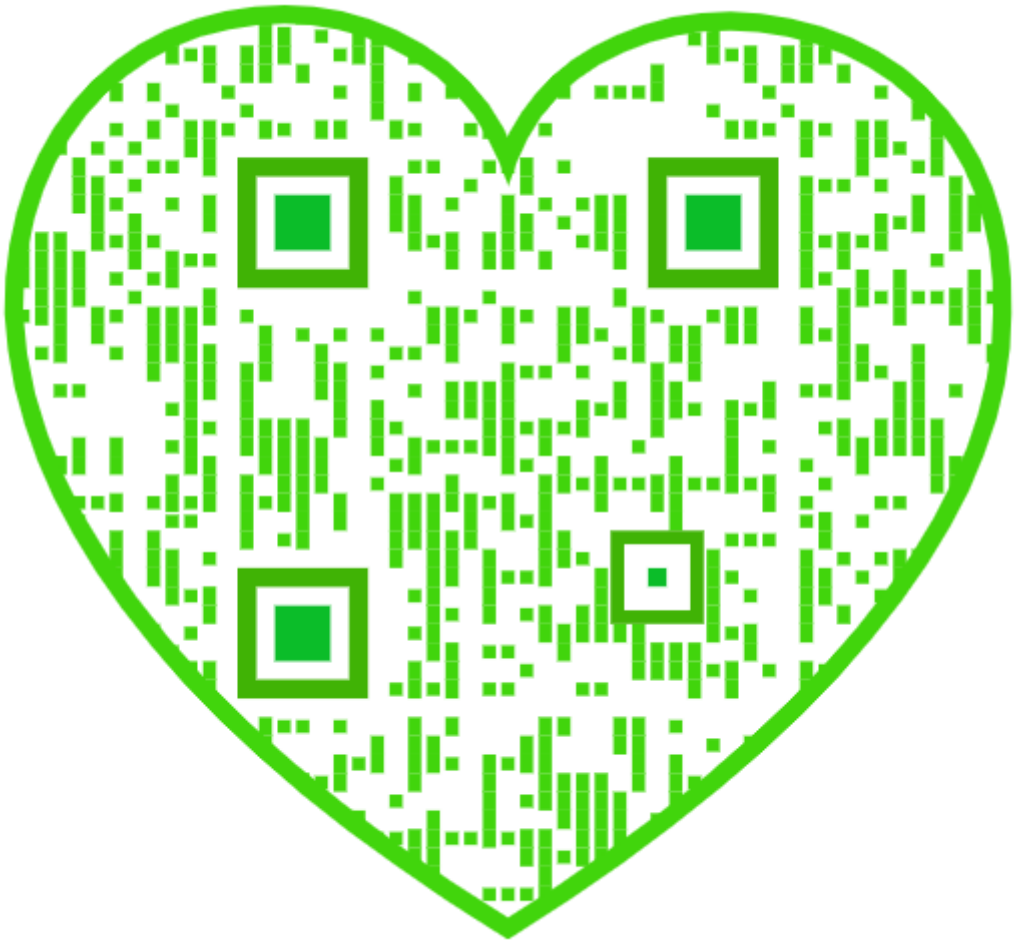

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NEW YORK, SATURDAY, SEPTEMBER 6, 1879.

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INTELLIGENT WORKMEN NEEDED.

Notice was taken in a recent issue of this paper of the experience of a large shoe manufacturer of this State, who advertised in Boston and New York for twenty-five shoe fitters to work in his factory, offering full current rates and steady work. The advertisement brought one application.

About the same time a Boston firm advertised for a book-keeper, and the next day's mail brought three hundred and forty-seven answers.

During the same month an advertisement for a clerk, in a Detroit paper, brought one hundred and thirty applications the first day, and a greater number of letters and personal applications the next day.

An advertisement for a week in the same city, calling for a good carpenter, brought only four replies.

It is altogether probable that in any considerable city in the land, an advertisement for a book-keeper or retail clerk will bring fifty times as many replies as an advertisement for a fair workman in any trade.

It is also probable that in any and every city the average earnings of clerks are nowhere near so large as the earnings of workmen of average skill in the various trades.

Further, it is fairly certain that, with equal capacity, industry, and thrift, the young man who learns any trade will achieve a reasonable competence sooner than the young man who sticks to clerking; while the chances for materially improving one's condition are more numerous in the trades than behind the counter or at the desk.

Why is it, then, that the boys all want to be clerks? Why is it that intelligent parents encourage them in looking for a chance to "get into business," and in looking down on mechanical employments—as though there could be any calling more wretchedly mechanical than average clerking? Why is it that teachers almost invariably train their pupils to "look above" mechanical pursuits?

What the country wants now is workmen—intelligent, industrious, thrifty workmen; men who can do skillfully the work that waits for the doing—who can invent new means and better processes for developing the crude resources of the land, and for converting brute matter into life sustaining and life-enriching wealth. Mere clerks and record keepers are at a discount. There are too many of them. And the professions, so called, are almost equally crowded with men who have nothing to do. There never was a time when ability to do something real and practical was worth so much as now. Yet our young men swarm after clerkships. Why is it?

HYDROPHOBIA SUCCESSFULLY TREATED WITH CURARE.

The *Medical Record* of Aug. 9 gives a detailed report of a case of hydrophobia successfully treated with curare, by Dr. Ad. Offenberg, of Wickrath, Rhenish Prussia.

The subject was a servant girl, 24 years of age, who was bit in the heel by a rabid Spitz dog, July 28, 1874. Two days after the wound was cauterized by means of a concentrated solution of caustic potash, and shortly after the girl underwent a course of treatment for hydrophobia. Subsequently, for three months or more, the wound was kept suppurating under the direction of a local physician. Seeing that the case was not receiving proper treatment, the pastor of the place brought about the transfer of the patient to a hospital, where she was received October 8. At that time the wound, on the outside of the left foot, extending from the tendo Achillis over the dorsum, presented a reddish granulating surface about the size of the palm of the hand. Under a simple dressing the granulating surface became much smaller, and until October 16 no change was observed in the patient's health and temper. Symptoms of rabies appeared that evening, and by 10:45 P.M. were pronounced and decided. Curare was then injected under the skin, and the dose was repeated several times during the night, with favorable effects. The last convulsion occurred at twenty-three minutes past four in the morning.

The details of the case would be out of place here; suffice it to say that the patient slowly recovered health and strength, isolated convulsive movements of slight severity occurring at intervals until the 24th, while impaired vision and oversensitiveness of the eyes to light continued still longer. On Dec. 3, the wound on the foot being completely cicatrized, and the patient's general health being good, she was allowed to return to her home. By January, 1875, she was able to resume her duties as servant, though her original health and strength were not restored for more than a year.

The case seems to have been one of genuine hydrophobia, notwithstanding the fact of recovery. The circumstance, however, that the patient attended a hydrophobic neighbor (who was bit by a rabid dog a few days before she was, and died of the disease), witnessing his convulsions and other symptoms, makes her case possibly one of simulation.

EARLY ADVOCATES OF SHIP RAILWAYS.

Since prominence has been given to Capt. Eads' suggestion for a ship railway across the Isthmus of Panama, there have arisen quite a number of claimants to the credit of first proposing this solution to the great problem. Thus far we have seen none antedating the plan illustrated in the first volume of the SCIENTIFIC AMERICAN; and no one seems to have taken the matter more to heart than the late Horace Day, for he went so far as to take out patents for his devices in this connection.

Before that time, however, the project of transporting ships by railways had been enthusiastically advocated by Mr. Philip C. Friese, in "An Essay on Party," published in this city as early as 1856, and copyrighted the year before. While discussing the competence of the general government to undertake investigations and experiments of a scientific and useful character, for the furtherance of national prosperity, Mr. Friese observed that water conveyances had been increased in size, through many increments, from the slight canoe to the vast steam ship, while land carriages had made no such progress. At that time the rail-car in use was but a small remove from the common road wagon. The American rail-car now shows a considerable increase in carrying capacity, yet the gain in no way approaches that made in shipping.

From this point of view Mr. Friese asked: "Why do we not construct rail-cars as broad and capacious as steamships? Why do we not dip up steamships from a river or ocean, place them in a rail-car, and whirl them overland to another river or ocean? Is it not pitiful that the swift and magnificent vehicles which convey our citizens and our commerce over the stormy deep, and which bear within them the power to scale the lofty mountains and skim the wide plains of our continent, should be checked in their proud career by a narrow isthmus? Why shall not the same power which turns a paddle-wheel through the water be made, by an easy mechanical contrivance, to turn a driving-wheel on a rail? The same power will be immensely more efficient on a rail than on the water, from the fact that friction on a rail is much less than on the water at the same speed, especially at a high rate of speed. Steamships themselves might form the bodies of cars, when placed in a frame, or cradle, over suitable running gear. If the track be made wide enough, cars may be converted into rolling hotels, two or more stories high, and may contain the chambers, parlors, dining-rooms, and other conveniences of steamships, if not of stationary public houses. The great law of economy, in regard to time and power, and fuel and labor, demands the establishment of broad roads, suitable for ships, and for large cars on the principal thoroughfares, say, on the isthmus routes of Panama, Tehuantepec, and Nicaragua, and on the trunk, if not on the branches of the great road which must connect the Atlantic with the Pacific, across the center of our continent. So the Isthmus of Suez may be overcome by a ship railroad. Unless unusual physical obstacles intervene, ship railroads may connect the Black Sea and the Caspian, and perhaps even the Aral, and this with the river Yang Tse Kiang. There would be as much comparative saving of time and power and labor by the employment of large cars instead of small ones, as there is in the employment of ships instead of canoes. Large cars could be driven with safety at a rate of speed not attainable by small ones. If the cars be adapted to steamships, these can leave the Atlantic ports, either going east or west overland, and arrive in the East Indies in a few days, without breaking bulk. For such a road, rivers, lakes, and inland seas would serve as switches and depots."

It is needless to follow Mr. Friese in his remarks concerning the military and naval advantages of ship railways, or to criticise his sweeping indifference to geographical obstructions. Practical railway men will probably laugh now, as they did a quarter of a century ago, at the idea of increasing the economy of ordinary transportation by largely increasing the size of cars; yet it is quite possible that for short portages, to avoid long voyages, ship railways may be more easily constructed and more economically than ship canals; in which case Mr. Friese is obviously entitled to his share of credit for early appreciating their advantages. That the idea of such a means of transportation was original with him is not for a moment to be supposed. The same may be said of Mr. N. W. Evans, who also claims priority in the invention, though he first suggested it in 1854, some ten years after the project had been illustrated in the SCIENTIFIC AMERICAN. Mr. Charles W. S. Heaton, who also puts in a claim, is fully twenty years behind, his proposition having been made as late as "1864, or early in 1865."

AMERICAN VINES IN FRANCE.

A notable illustration of the balance between animal and vegetable life under natural conditions is furnished by the power of American vines to withstand the attacks of phylloxera. For unnumbered ages the conflict between the plant and the insect has been going on in this country, the result being the survival of those species of the grape capable of enduring the attacks of the parasite. This power of resistance has been found to reside in the rapid lignifying of the roots of the American grapes, so that the punctures of the phylloxera are comparatively harmless. They affect the outer bark only, causing little excrescences which fall off like warts. European vines, on the other hand, have not been subject to such invasions (until recently), and are entirely unable to cope with the pest. When pierced by the insect the tender roots decay, and the entire plant perishes. The consequence is that having once been introduced in Europe, as it was about twenty years ago, the phylloxera meets with no resistance, and the indications are that nothing short of the extermination of all European vines will stay its destroying progress.

Our readers are familiar with the decision of the French Commissioners in favor of the substitution of the native grape stocks by those of American origin, as set forth in their official report, translated for the issue of the SCIENTIFIC AMERICAN, dated August 2. Our American Consul at La Rochelle, Mr. George L. Catlin, now writes that the prefect of that department has taken steps to establish there a monster nursery of American grapes (notably the Jacquez

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and Herbemont) to afford the French vine growers, whose vineyards have been ravaged by the phylloxera, an opportunity to re-establish them with resisting stocks. Already the prefect has had planted in a vineyard of his own 42,000 American shoots; and Mr. Catlin anticipates a very large demand for American vines throughout France.

READING AT SEVEN AND A HALF MILES DISTANCE FROM THE CANDLE.

On the evening of July 12, the Maxim electric light was put in operation on the tower of the Grand Union Hotel, Saratoga Springs, N. Y., with a view to test the extent of its illuminating powers. An open parabolic reflector was used—no lenses—and care was taken by Mr. Maxim to set the points of the carbons a little at one side of each other, and to adjust them to the exact focus of the reflector. When this was fairly accomplished the light was turned toward a spot in Ballston Spa, New York, 7½ miles distant, where, by previous arrangement, a group of several hundred persons were assembled to witness the experiment. So powerful was the light, so accurate the focusing and alignment, that the designated place in Ballston was instantly illuminated, so that ordinary print could be read, the time seen on watches, etc. The night was clear, still, and dark. The experiment was made at 9½ o'clock P. M. This is believed to be the greatest distance at which illumination of equal degree has been accomplished. We are indebted to Mr. H. S. Maxim for the above particulars.

A COVERING WANTED FOR COTTON BALES.

Among the matters of general interest brought forward at the recent convention of the National Cotton Exchange in this city, one ought to be of special interest to inventors. Speaking of the proposed reform in selling cotton, namely by net weight, President Lafitte said that it would be to the interest of planters not to have any allowance made for bagging. The cheap bagging now used is a poor protection to the cotton, and would soon be superseded under the new rule. In his own words: "If cotton were sold by net weight, some inventive genius would, in a few years, introduce good non-inflammable light material," for covering the bales, thus saving much waste, damage, extra freightage, and so on. The problem does not appear to be a very difficult one, and its solution would pay well. The disadvantages attending the use of unrotted flax bagging was particularly noted. The texture is rough and open, affording an insufficient covering, and allowing the cotton to deteriorate in value, while the expenses for mending the bales were considerably increased. Mr. John G. Dale, agent of the British and Foreign Marine Insurance Company, said that his company had sustained heavy losses from the use of such bagging, and had been obliged to make large deductions from claims by way of protest.

Mr. Trenholm estimated the cotton crop of this year at 5,250,000 bales. If they were placed together in one long string they would measure about 4,500 miles, and stretch from New Orleans to New York, and thence across the Atlantic Ocean. Every linear foot would represent 100 lb. of cotton. With regard to the prospects of the future, Mr. Trenholm said that now but one bale of cotton was produced to 2 4-10 acres of land, but it was possible, by proper management, as experience had demonstrated, to raise one bale to every acre. He believed that ultimately our crop would be 12,500,000 bales.

In view of these figures it is needless to urge the importance of the invention called for. Our wide awake inventors should see that the want is met promptly.

A SINGULAR MEMORY.

Marvelous stories are told of the curious memory of D. P. Hicks, a Rochester youth, associated with a not less curious faculty for distinguishing sounds. He spent his earlier years in Buffalo, N. Y., where he became known to railway men for his singular knowledge of locomotive bells and numbers.

A short time ago he removed to Rochester, where he is employed at a distance from the railway so great that he rarely hears a passing train. Yet he is able to give the numbers of nearly three hundred locomotives on hearing their bells. The engines that run in the night he names with unerring accuracy, as his house is situated near the track and the bells are heard very plainly. Railroad men state that this is the only case of the kind they ever knew. Old and experienced engineers, switchmen, and those whose work bring them within the hearing of a large number of engine bells, say that at the most they can learn to know only a very few compared to the great number Mr. Hicks can name readily, almost without thought. He can not only give the numbers of several hundred, but in cases where locomotives have been remodeled and renumbered, he can give the old number as well as the new one. He says there are six locomotives familiar to him, the bells of which are keyed in pairs. These six locomotives are the only ones, to his knowledge, in the old class, which have the same key. The new locomotives, that is, those the numbers of which are above 500, are all keyed nearly alike.

The Rochester *Democrat and Chronicle* relates that not long ago an old switch engine, used in the yard at Buffalo, was sent to Rochester for some special purpose. As it passed Dean street Mr. Hicks heard the bell and remarked that the engine was of a certain number, and that he had not heard its bell for six years. A boarder in the house, anxious to test the case, ran to the track and found that Mr. Hicks was correct. Not long since the young man went to Syracuse on business. He heard an engine coming out of the round house, and remarked to a friend that he knew the bell, although he had not heard it in five years. When the engine came into view the number given was found to be correct.

This faculty, it is said, has been tested hundreds of times, and a mistake is rarely made.

FOUR HOURS IN THE DARK.

It is a humiliating confession to make—but geography is pitiless, and our national vainglory must bow to its decrees—that for four hours in every twenty-four the entire territory of the United States is deprived of sunshine. As the sun goes down on our farthest Aleutian island its morning rays are just lighting up the hill tops of the western coast of Ireland, and the breadth of the Atlantic lies between us and daylight. To our Fenian citizens this may be another and cogent reason for annexing the dear little isle of the harp and the shamrock; but until it is done the exultant cry of the *Rocky Mountain Presbyterian*, that the sun never sets on the United States, must be admitted to be a trifle exaggerated. It does set every day, and, paradoxically, four hours before it rises.

In the depth of our humiliation we may possibly console ourselves with the reflection that—though our British cousins can say with truth what we cannot—the sun really shines on the United States when it is up. We have to submit to four hours of sunlessness a day: England is lucky to get four hours of sunshine. So life has its compensations, and existence in the United States remains endurable, though we do not (geographically speaking) make quite so great a spread as we thought.

The New Eddystone Lighthouse.

The foundation stone of the new Eddystone Lighthouse was laid, August 19, by the Duke of Edinburgh. The formal commencement of the structure on the 21st of June, as first proposed, was prevented by the roughness of the sea. On the day of the final celebration the weather was rainy, but the water was sufficiently smooth to permit the carrying out of the programme.

The Eddystone rocks are situated in the English Channel, 14 miles southwest of the port of Plymouth and 12½ from Rame Head. They are almost in the line which joins the Start and Lizard points, and in the fair way of all vessels coasting the southern shore of England. So exposed are they to the ocean swell from the south and west that even in comparatively calm weather the waves go raging and thundering over their ledges, and their name indicates the incessant swirl of the deep about them.

The new lighthouse will stand 127 feet from the present tower on the South Reef, a rock which the House Rock protects from the southwest, but which has the disadvantage of being much lower, its highest part being never uncovered before half tide, while the lowest parts, on which most of the foundation rests, are 4 feet beneath the low water level of an ordinary spring tide.

Most of the work done thus far has had to be done under water, and owing to the force of the waves the work could be carried on only at brief and specially favorable intervals. It is expected that the high water level will be reached early next year, when the work will proceed more rapidly, as the courses of stone are all accurately fitted together on shore. It is thought that it will take five years to complete the lighthouse, which is to follow generally the lines of the present one, though it will differ from it slightly in form and considerably in size. To a height of 25½ feet above high water mark the tower will be solid, with the exception of a space for a water tank. The side walls beginning at this level will be 8½ feet thick, diminishing to 2¼ feet at the top. Nothing but granite will be used, and the blocks will be large enough to form the entire thickness of the hollow portion of the tower. Under the cornice, to the top of which it is 138 feet from the rock, the diameter of the tower will be 18½ feet; it will contain nine rooms, besides the lantern, each being 10 feet high and the seven uppermost ones 14 feet in diameter. The focal plane of the new lighthouse will be 130 feet above high water, as compared with 72 feet in the present building, and the actual useful range of the light will thus be extended from 14 to 17½ nautical miles. About 5,100 tons of granite will be employed in the construction, and 50 tons of iron for door casings and the like. The fog-bell, erected in 1872, will be replaced by a powerful siren and the electric light probably be used. The estimated cost of the entire work is between $300,000 and $350,000. A large engraving of the Old Light house, with a view of the foundation of the new structure, is given in the SCIENTIFIC AMERICAN SUPPLEMENT, for August 23.

American Dental Convention.

The twenty-fifth annual session of the American Dental Convention was held in Saratoga, August 12. The attendance was small. The relative merits of gold, amalgam, and other plastic fillings for teeth, were discussed, the prevailing opinion being in favor of the first named, and against the "new departure," so called, in the direction of substitutes for gold fillings.

The Oldest Scientific Lecturer.

M. Chevreul, now in his 93d year, began his usual course of lectures on organic chemistry at the Museum of Natural History, Paris, on June 10.

A New Fluorescent Body.

According to the *Journal of the Chemical Society*, C. O. Harz has discovered a new fluorescent body in *spergulin*. This product occurs in the seed-coverings of the caryophyllaceous plants, *Spergula vulgaris* and *S. maxima* (Anglice "Spurrey"). It is produced at the time when the seeds blacken and are nearly ripe. Spergulin is very soluble in absolute and aqueous alcohol. Viewed by transmitted light the solution appears nearly colorless, with a shade of olive-green; by reflected light it exhibits a dark-blue fluorescence. It has not yet been obtained in the form of crystals. It is very soluble in methylic alcohol, less so in amylic alcohol, and scarcely soluble in ether or petroleum. Concentrated sulphuric acid dissolves it, forming a dark-blue liquid. The fluorescence of an alcoholic solution of spergulin is maintained for more than a year if the liquid be kept in darkness, but is rapidly destroyed by the action of direct sunlight, and more slowly by that of diffused light. Small quantities of caustic alkalies, or alkaline carbonates, added to an alcoholic solution of spergulin, transform it into an emerald-green fluorescent body; and basic lead acetate produces a precipitate. The new compound contains 61·85 per cent of carbon, 7·05 of hydrogen, and 31·8 of oxygen. It appears to be related to chlorophyl, and is probably closely allied to phyllocyanin. An alcoholic solution of the product showed strong absorption, almost entirely in the violet; and in this respect differs considerably from chlorophyl, phyllocyanin, and phylloxanthin. Mr. Harz is disposed to regard spergulin as a feeble acid, the acid salts of which, as well as the acid itself, exhibit blue fluorescence, the neutral salts exhibit green fluorescence, and the basic salts are destitute of fluorescent properties.

The Railroads of the United States.

The twelfth annual number of Poor's Manual of Railroads of the United States is unprecedentedly full of information, owing to the more detailed statements furnished by the companies and the reports of State departments for the general oversight of railroads. For the first time for several years the introductory article is able to record a very decided recovery of the railway interests of the country from their recent depressed condition. The total mileage in operation at the close of the year was 81,841 miles, 2,694 miles of new line having been opened during the year.

The construction of railways has been entered upon with renewed energy and activity, and it is predicted that construction will proceed rapidly until the mileage is more than double what it is now. In the five years since 1873 there have been constructed in the United States 11,563 miles of railway. A remarkable feature in the railroad operations of the country for several years past has been the enormously increased tonnage in the face of a large falling off of earnings. The decline in earnings has been due to very great reductions in charges for transportation. Within the last decade the tonnage traffic of our railroads longest in operation has been fully doubled, while there has been only an inconsiderable increase in earnings from this source. Since 1873, the year in which the earnings of our railroads reached their maximum, the increase of their tonnage has equaled 50 per cent, although the period has been one of unexampled business depression. At the very time at which there has been the greatest complaint of hard times, the movement of merchandise has steadily and largely increased.

The gross earnings of all the roads whose operations have been reported, have equaled $490,103,361, against $472,909,272 for 1877, $497,257,959 for 1876, and $503,065,505 for 1875.

Sydney Exhibition.

The last number of the *Illustrated Sydney News* received at this office represents, by a number of well executed wood engravings, the progress of the Sydney Exhibition, showing the arrival and placing of exhibits from all countries, and exhibiting that same degree of hurly-burly activity which was witnessed just before the opening of our Centennial show, and which prevailed just before the opening of the French Exhibition last year.

From these illustrations and the statements of the newspapers of that far-away colony, the success of the Exhibition would seem to be secured. Now for the New York World's Fair in 1883. Are we to have it? If so, it is time steps were taken to select a site, and some announcement made of what the committee intend doing.

Professor Archibald Geikie.

Professor Geikie, the accomplished chief of the Geological Survey of Scotland, recently passed through this city on his way to the West. His purpose was to go first to Ogden, then, after visiting Salt Lake, to study the Wahsatch and Uintah mountains and the ancient lake basins of that region. On his return to the East, Prof. Geikie will deliver a course of lectures on "Geographical Evolution" at the Lowell Institute.

The California Big Ferry Boat.

We are indebted to Dr. Edward Gray, M.D., for some additional particulars concerning this vessel, the Solano, recently noticed in our paper. Her length is 425 feet; breadth, 115 feet; built at Oakland, where she is now receiving her finishing touches. The vessel is to ply on the Straits of Carquinez, between the railway station of that name and Benicia, and not on San Francisco bay as stated.

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THE BELGIAN SYSTEM OF CANAL TOWING.

[*Continued from first page.*]

port. It is 14 inch bore and 16 inch stroke. The boiler—of the locomotive style—has a 5 foot shell, and is 14 feet long.

The screw receives its motion through clutch gearing, shown in Fig. 5. The miter wheels on the engine shaft are loose. The clutch slides on a feather, so that when it is brought into engagement with either wheel it will carry it, and consequently drive the wheel on the screw shaft. This mode of gearing is found to answer the purpose as the screw is seldom used.

The boats are calculated for towing from four to five canal boats at a speed of three miles per hour. The method of making up and towing a train of boats is shown in the front page engraving. The machinery for these boats is built by the Pound Manufacturing Co., of Lockport, N. Y. The boats are built by H. Benedict & Co., of Lockport. Ten of these boats have already been built; fifteen more are to be completed next winter The company intend to build eighty in all.

Our large engraving not only gives an excellent idea of the Belgian system of towing, but it also shows the locks of Lockport, where the boats are raised and lowered 60 feet The difference in the two water levels affords the city of Lockport one of the finest water privileges in the world. Clustered around the locks and along the course of a race on the left bank are factories which are driven by water from the upper canal level. Beyond the bank on the left and in the hollow just out of sight in our view are the Pound Works. The large buildings on the left of the locks are the Holly Works, of which we have several times made mention. At the foot of the locks is a small building containing the pumps that supply Lockport with water for extinguishing fires and all other purposes, except cooking and drinking.

There is another matter of engineering interest connected with the spot shown in the engraving, namely, the transmission of power by means of wire cables. There is probably not another place in the country where this method of transmitting power is employed to such an extent as within the area covered by our engraving. A 30 inch turbine at the Pound Works distributes power through five cables to manufacturers of various kinds upon and beyond the embankment. The Richmond Works, on the extreme right of the engraving, supply power through two cables that run across the gully, one being 2,100 feet long, the other 1,600 feet; also through other cables to five other establishments upon and beyond the right bank. A 40 inch turbine under a 65 foot head supplies the power. One of these cables, 1,100 feet long, runs around corners and is supported upon poles. About 20,000 feet of cable are kept in motion by these two turbines.

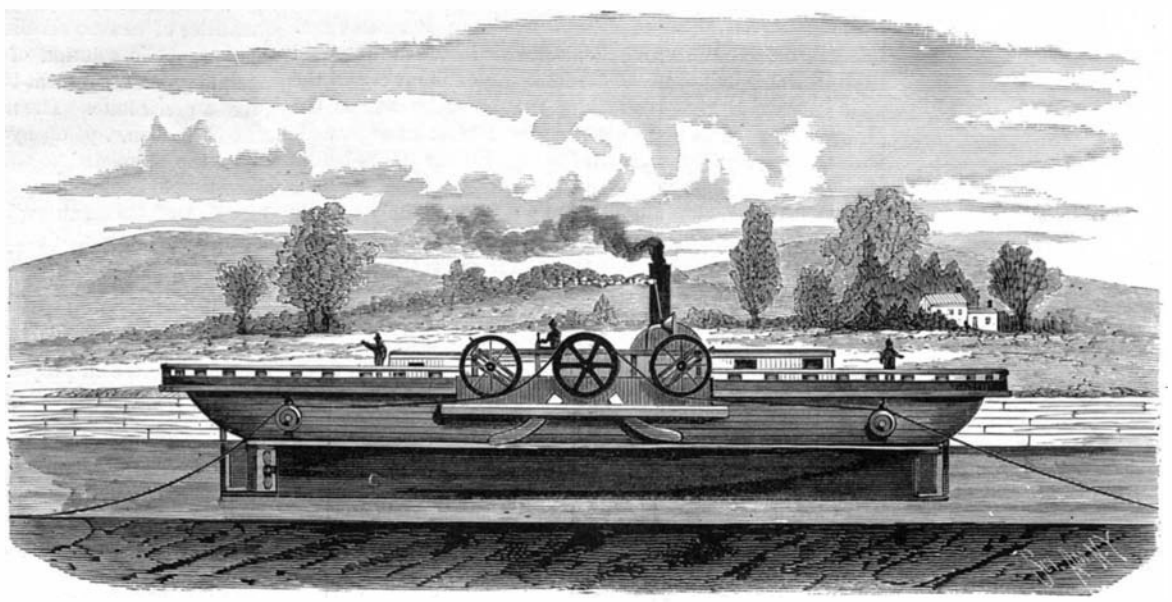
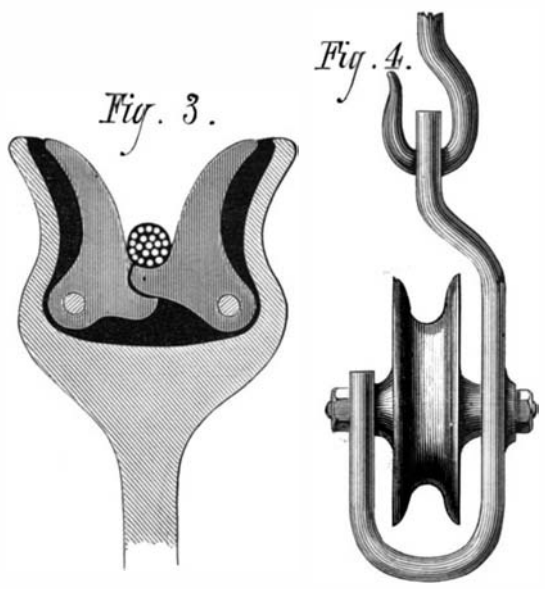


Fig. 2.—SIDE ELEVATION OF CABLE TOW BOAT.



CLIP IN DRIVE WHEEL. TAKE-UP SHEAVE.

MISCELLANEOUS INVENTIONS.

Mr. George H. Hutton, of Boonsborough, Md., has patented an improvement in jump-seats for vehicles, which consists of a stop or locking device for supporting the pivoted or shifting seats of vehicles and holding them firmly when elevated, so that they will have no swaying or lateral movement.

A seal and a lock for doors of freight cars, and also stationary structures, have been patented by Mr. John T. Kilham, of Harper's Ferry, W. Va. It is so constructed that when the seal or plate containing the seal proper is duly attached it prevents the lock bolt which secures the hasp from being withdrawn, and hence the door cannot be opened. When the seal plate is broken the lock bolt is released, and by proper manipulation can be withdrawn from the lock, thus in turn releasing the hasp and allowing the door to be opened.

An improved fire extinguishing attachment for buildings, which is so constructed that water may be thrown over all parts of the buildings, inside and outside, to prevent them from taking fire from a contiguous burning building, and to extinguish the fire if it has already started, has been patented by Mr. Edward M. Whyler, of Hays City, Kan.

An improvement in gates, patented by Mr. Moses Derby, of Pepin, Wis., consists in certain novel features of construction, whereby the gate is adapted for swinging in either direction, and may be raised to clear obstructions.

Mr. Marshall McDonald, of Lexington, Va., has patented an improved fishway, in which is utilized the velocity or pressure of the head of water at the dam by directing the head of water through a series of openings on an incline, the openings being arranged to discharge upwardly, so that an initial upward current on the incline is produced, which enables the fish to ascend the incline.

A lamp top or burner, having a socket in its upper portion and a detachable mouthpiece or tip provided with a tenon or reduced portion which fits therein, has been patented by Mr. William C. McCormack, of Stanford, Ky.

An improved check for oil wells has been patented by Mr. Jasper Neath, of Shamburg, Pa. It consists in an external packing device applied in connection with the usual packing devices, or at one of the lower joints in the tubing, to prevent any flow of oil through the tubing, so that when sufficient pressure has accumulated to cause a flow the oil will pass outside the tubing by the casing to the tanks.

Mr. Griffith B. Thomas, of Point Pleasant, West Va., has invented an improvement in iron roofing, which consists in forming the joints between the sheets by crimping the edge of one over the turned up edge of the adjoining sheet the whole length, and then fastening them by clips of tin.

Mr. Benjamin F. Wood, of New Haven, Conn., has invented an improved frame for drying lace curtains under tension. It is simple in construction, and will hold the curtains under a uniform tension while drying. When not required for use it can be folded into compact form for storage or transportation.

Mr. Paul H. Seager, of Manteno, Ill., has patented an improvement in stovepipes, which consists of a section of pipe unriveted at the lower end so that its diameter at this end can be increased and diminished at pleasure by means of a lever pivoted to the pipe on one side and connected by a strap with the other side. By moving the lever back and forth the pipe is contracted and expanded, and secured in any desired position by a pawl engaging a ratchet guard over the lever.

An improvement in flour bolts has been patented by Mr. Josiah J. Zinn, of Union City, Pa. The object of this invention is to construct the reels so that a smoother surface will be given to the bolting cloth, for the purpose of permitting a sliding motion of the meal when it is in operation, and thus enable the flour to be bolted more evenly and cleanly than is now done.

Mr. Rienza A. Goldsmith, of Washingtonville, N. Y., has invented an improvement in thill couplings, which consists in forming upon the head of a coupling bolt a plate with a hole through which the cam bolt passes, so that the coupling bolt may be secured by the nut that holds the cam bolt.

A composition for water filters, formed of clay, sand, wood sawdust, pulverized pumice stone, and English calcimine, mixed together in about equal quantities, with sufficient water to reduce the mixture to a plastic state, has been patented by Mr. Jean B. Ader, Aîné, of New Orleans, La.

An improved flood gate, which is so constructed as to swing open as the water rises and swing shut as the water falls, which will prevent trash from lodging about its hinges, and may be readily adjusted to the height of the water at different seasons of the year, has been patented by Mr. William B. Akers, of Little River, Va.

Mr. John Ames, Jr., of New York city, has patented an improvement in making brushes. The invention consists in a knot formed by dipping the loose butts of the bristles into melted pitch, glue, or cement, and inserting them in a form, where they are allowed to cool or harden.

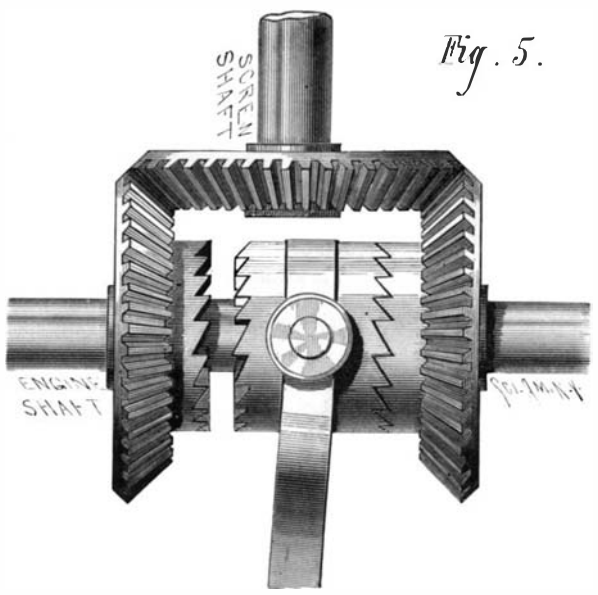
Mr. Louis A. Bringier, of Ascension Parish, La., has patented an improvement in back-bands for plow harnesses. It consists in a connecting device of peculiar form for holding the traces and preventing their detachment.

An improvement in the class of foot-rests which are composed of two plates or thin boards hinged together, so that when the device is in use one of the plates will be at right angles to the other, but when not in use one plate may be folded flat upon the other, is the invention of Mr. Henry Jungmann, of Madison, Wis.

Mr. Maximilian C. F. Nitze, of Dresden, Saxony, has patented an improvement in application of electric light to a speculum. The object of the invention is to provide a means for direct illumination and examination of internal parts or cavities of the body, as the urethra, the bladder, the larynx, the esophagus, the stomach, the uterus, the outer auditory passage. This method, and the instruments constructed according to this method, afford the possibility of introducing the source of light into the internal parts or cavities themselves for examining the part directly, or its reflected image. Lenses or lens systems for enlarging the field of view may be employed in combination with his instruments. The source of light employed in these instruments consists in a platinum wire made incandescent by an electric current. The white heat of this wire is taken up and made harmless by means of a cold water current flowing along the circuit wire.

An improved machine for perforating papers, so that letters, numbers, or other characters may be represented thereon by a series of perforations, has been patented by M. Henri L. Poirier, of Paris, France. The punch holder is so constructed that the punches may be readily replaced when they are worn, and they may be grouped in the prisms so as to change the characters to be reproduced in perforations.

Mr. Albion B. Parkman, of St. Albans, Me., has invented an improved hame fastener, which consists of the hollow shank or body containing snap hooks, the shank of one of which has sharp teeth on its upper face, while the shank of the other is provided with square teeth on its upper face, which are held in the shank by the dogs that are pivoted within the body of the fastener, and made to engage with the teeth of the snap hooks by a curved spring.



SCREW DRIVING GEAR.

An improved washing machine has been patented by Mr. Zohar Doyle, of Ogden, Ill. It consists of two semi conical pressers, with air tubes to prevent suction, mounted in a head held upon a frame operated by a lever and springs, and adapted to be shifted about, so as to be directed upon the surface of all the clothing.

Mr. Emery M. Pike, of McDonough, N. Y., has patented improvements on the butter worker for which letters patent No. 179,053 were granted to him June 20, 1876. In that apparatus a frame, provided with a trough or gutter, supported a reciprocating tank provided with an eduction pipe. The present invention consists in details of construction and arrangement of various parts of the apparatus, whereby provision is made for lessening the friction, for disposing of the brine, and for insuring the proper operation of the apparatus

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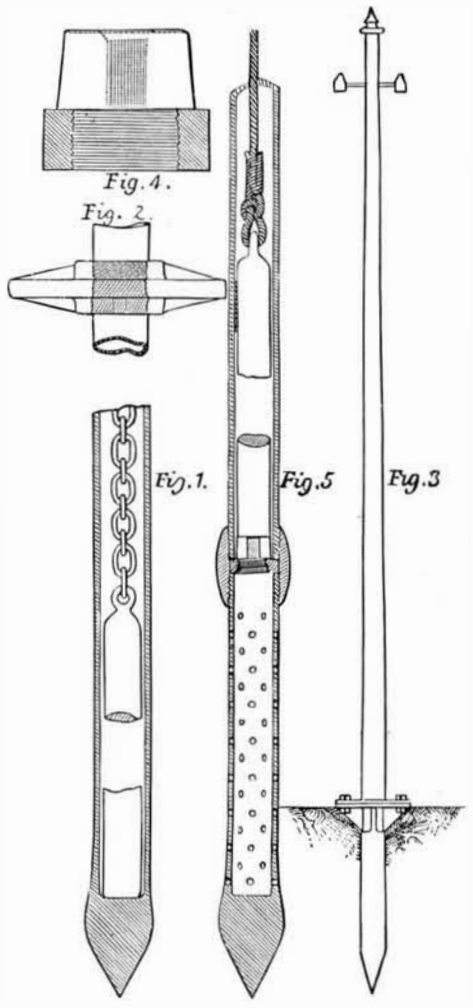
TUBULAR PILES.

A novel and ingenious system of constructing and driving piles has of late been introduced into practice by Messrs. Le Grand & Sutcliff, of London, artesian well engineers. It involves a considerable departure from ordinary practice, inasmuch as the piles are driven internally and at the bottom, instead of externally and at the top. The invention originated with the senior member of the firm, whilst the credit of some of the applications of the principle is due to the junior member. The piles, says *Engineering*, are tubular, and can



TUBULAR PILES.

be made of either wrought or cast iron, and the thickness of the metal can be proportioned to suit the varying circumstances of construction. The lower end of the pile, as shown in Figs. 1 and 6 of our engravings, is made solid and pointed, and is generally of wrought iron and steel tipped. The piles are made in sections, which are screwed together by strong steel sockets or joint covers, which are barrel shaped on the outside in order to diminish friction when being driven.

The method of driving these piles is as simple as it is novel. Instead of the blows being delivered on the head of the pile, the driving force is expended just where it is wanted, namely, at the point. This result is attained by using an elongated cylindrical driving weight, which travels easily inside the tube. The weight is raised by means of rope or rods, and is allowed to fall on the flat head of the solid point, the pile thus forming its own guide for the driving weight. The effect of each blow is to drag rather than to drive the pile down. It will be seen that the point is swelled, and is of sufficient diameter to effect a clearance for the joint covers which have to follow it down. The form of the joint cover is seen in Fig. 5. A considerable experience in driving tubes into the ground has shown the inventors that, thus made, the point does all the real work, and that a very slight strain is brought on the joints above. An increase of stability is given to these piles in cases where the depth to which they have to be driven is previously known by the use of a flange which is proportioned to suit the nature of the soil into which the pile has to be driven. This flange is shown at Fig. 2, and is so placed that at the final driving it just embeds itself on the river or sea bottom. The tubes forming the pile are screwed into the flange, which in this case takes the place of the usual steel socket, and unites the two lengths of the pile together. It thus in no way diminishes the strength of the pile as it would if screwed on to the tube below an ordinary socket.

With this system of piles it is not necessary to test the ground previously to driving them, inasmuch as lengths can always be added until a firm foundation is reached, failing which the pile can be withdrawn. In prospecting for a site small tubes can very rapidly be driven to ascertain the nature of the soil. Another advantage the system possesses is that piles can be driven in deep water with great facility, and they can be of extreme length. Their strength, moreover, can be increased by filling them in with concrete after they have been driven, if desired. When meeting with obstructions, screw piles have a tendency to become diverted from their position, and are liable to loosen the ground around them. The tubular pile, on the other hand, is not open to this objection, as it will fracture and pass through minor obstructions until it reaches a solid foundation, and being forcibly driven into the ground, the earth firmly surrounds it. These piles are applicable to all classes of engineering work, and they are now being tried by the Royal Engineer Committee, under instructions from the Under Secretary of State for War.

The principle of internal driving has been applied by Messrs. Le Grand & Sutcliff to the sinking of tube wells, driving the foundations for telegraph posts (as shown in Figs 3, 7, and 8), flagstaffs, and the like. When used in connection with tube wells a slightly modified arrangement has to be employed in consequence of the necessity which then arises for keeping out of the tube the water, which in the ordinary way flows in through the perforations. In this case the first socket above the perforated end is made sufficiently long to admit of a stout iron ring or washer being placed in the center of it in such a way that the two lengths of tube when screwed tightly together butt against it, one on the under and one on the upper surface. The interior of this ring is of sufficient size to allow the water to pass freely through it, but it has a screw thread cut throughout its whole length. During the operation of driving, the opening in this ring is closed by a steel plug, which is screwed down into it until the upper part butts on the ring, as seen at Fig. 4, where the ring is shown in section. The upper part of the plug forms an anvil, upon which the driving weight falls, the blow being thus delivered a short distance above the point of the tube instead of directly upon it, as in the case of the piles. In the center of a plug a hole is bored and tapped, into which a rod can be screwed for removing the plug when the driving has been completed. The male thread on the exterior of the plug is cut left handed, so that ordinary boring rods can be used in removing the plug without incurring the risk of unscrewing them.

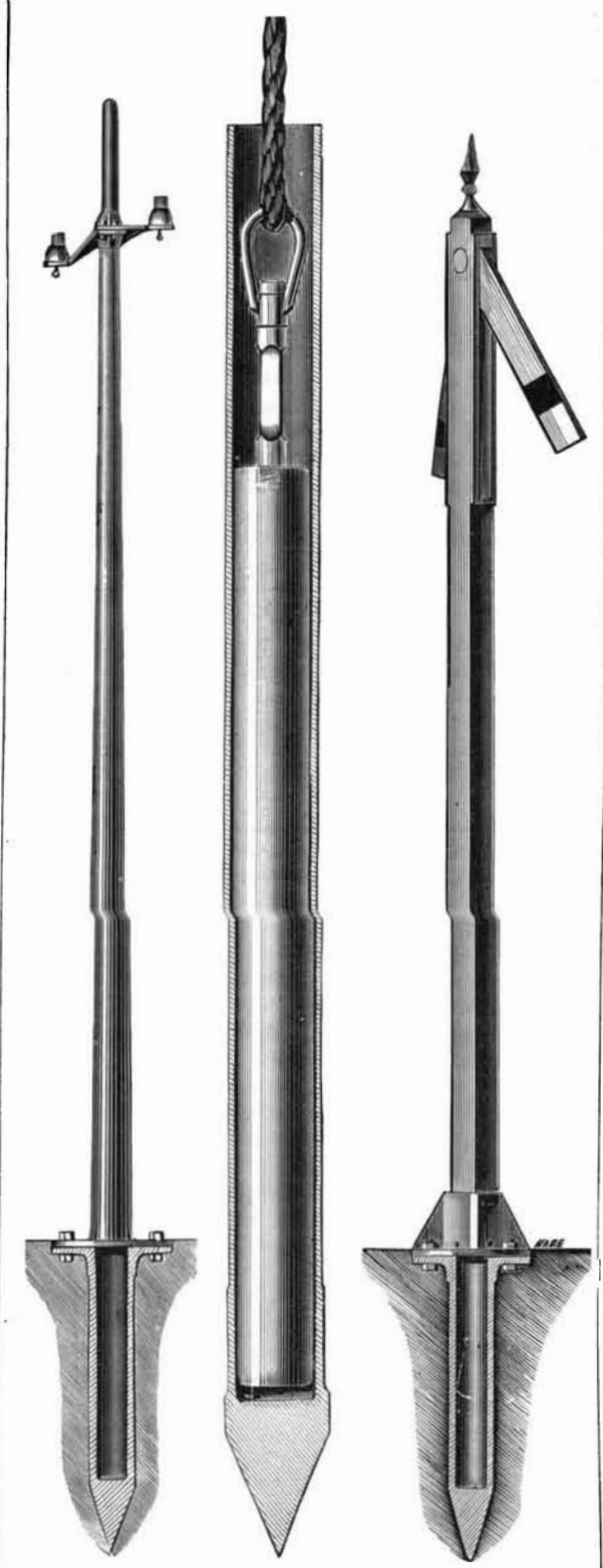


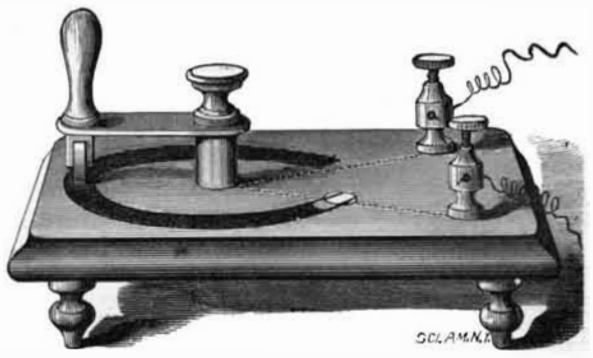
Fig. 7. Fig. 6. Fig. 8.

TUBULAR PILES.

The general arrangement of this system of driving tube wells is shown at Fig. 5. It will be seen that the water cannot rise in the tube above the underside of the steel plug, and in practice no difficulty has been experienced in any other respect. Altogether the system is one which commends itself for its simplicity, and for the facility it offers for carrying out that class of works to which the invention addresses itself.

IMPROVED RHEOSTAT.

The rheostat shown in the engraving is the invention of Mr. John Butler, of this city. It is designed for introducing more or less resistance into an electrical circuit. The bed plate is made of non-conducting material, and in an annular groove in its upper surface there is a film or plate of material that offers considerable resistance to the electrical current. Generally the groove is partly filled with plumbago. One end of the resistant is connected with a battery, and the current is completed through a movable key whose pivot is at the center of the circular groove. The key is provided with a roller



BUTLER'S RHEOSTAT.

which rests upon the plumbago and moves over its surface without abrading it.

This rheostat seems especially adapted to the use of physicians and experimenters.

IMPROVED INSTRUMENT FOR RINGING SWINE.

The instrument shown in the engraving is used for forcing through the flesh and gristle of a hog's nose one end of a piece of wire, while the other end remains at rest. The main object is to close the ends of the wire together outside of the flesh, so that the joint cannot enter and irritate the wound. The invention consists of a pair of pincers having

INSTRUMENT FOR RINGING SWINE.

one curved and one V shaped jaw, each jaw having a guide groove for receiving the pointed wire which forms the ring. The wire, slightly curved at one end, is inserted between the jaws, when, by closing the handle, the end of the wire will be forced through the hog's nose and bent up into a ring.

This device is the invention of Mr. W. D. Brown, of Indianapolis, Ind.

Wood Stains.

To turn oak black so as to cause it to resemble ebony, the wood should be immersed for forty-eight hours in a hot saturated solution of alum, and then brushed over several times with a logwood decoction, prepared as follows: Boil one part of best logwood with ten parts of water, filter through linen, and evaporate at a gentle heat until the volume is reduced one half. To every quart of this add from ten to fifteen drops of a saturated solution of indigo, completely neutral. After applying this dye to the wood, rub the latter with a saturated and filtered solution of verdigris in hot concentrated acetic acid, and repeat the operation until a black of the desired intensity is obtained. To imitate rosewood a concentrated solution of hypermanganate of potassa is spread on the surface of the wood, and allowed to act until the desired shade is obtained. Five minutes suffice ordinarily to give a deep color. A few trials will indicate the proper proportions. The hypermanganate of potassa is decomposed by the vegetable fibers with the precipitation of brown peroxide of manganese, which the influence of the potassa, at the same time set free, fixes in a durable manner on the fibers. When the action is terminated, the wood is carefully washed with water, dried, and then oiled and polished in the usual manner. The effect produced by this process on several woods is remarkable. On the cherry, especially, it gives a beautiful red color.

Antidote to Poison.

If a person swallows any poison whatever, or has fallen into convulsions from having overloaded the stomach, an instantaneous remedy, most efficient and applicable in a large number of cases, is a heaping teaspoonful of common salt, and as much ground mustard, stirred rapidly in a teacupful of water, warm or cold, and swallowed instantly. It is scarcely down before it begins to come up, bringing with it the remaining contents of the stomach; and lest there be any remnant of the poison, however small, let the white of an egg or a teaspoonful of strong coffee be swallowed as soon as the stomach is quiet, because these very common articles nullify a large number of virulent poisons.—*Medical Brief*.

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Correspondence.

The Bodie Mining District.

To the Editor of the Scientific American :

The most promising field for mining enterprise on the Pacific Coast at the present time is undoubtedly the Bodie District. The Comstock Lode has ceased any longer to attract that universal attention which for so many years it has monopolized. The dividends of its mines have stopped, and investors are looking to the Bodie and other fields for opportunities that the Comstock no longer furnishes. Here on the coast mining has been reduced to a scientific basis. The element of chance is more and more eliminated; and sound hypotheses based on geological facts and years of careful experiment, guide the prospecting and development of new mines. The Bodie District, which I purpose to describe, is located in Mono county, California, near the Nevada line. It is about 36 hours' ride from San Francisco, almost due west. It is reached, however, by way of Carson, from which place you stage it over the country 110 miles. The first individual who discovered valuable mineral deposits in this district was W. S. Bodie, of Poughkeepsie, New York. This was as long ago as 1859, and from this enterprising prospector the district has taken its name, being organized as such in July, 1860. The Mono section was first worked, but not systematically; and in 1861, what was then known as Bunker Hill (since famous as the Standard) was discovered. A company, with a nominal capital of $1,110,000, was incorporated in 1863, but failed in any practical results, although such names as Leland Stanford and F. K. Bechtel were at its head. In the following year the Empire Company of New York was incorporated, combining four or five other mines, with $10,000,000 capital. Trenor W. Park succeeded in raising $300,000 actual money on stock sales for development purposes. The effort as a whole, however, proved entirely theatrical. A very good mill had been erected, and ten years later, when the Syndicate Company was incorporated with large privileges, this was refitted, and with a sufficient capital work began in earnest. Then followed the astonishing developments in the Bunker Hill (Standard) mine which brought abundance of working capital into the district, and speedily the Bechtel, the McClinton, Belvidere, Bulwer, Bodie, Mono, Tioga-Con., and other mines were opened up; followed, since the establishment of the "Veta Madre" theory (or mother vein), by the Dudley, Jupiter, South Bulwer, Chieftain, Noonday, Richer, and a host of others.

The geological character of the entire district is volcanic—"a volcano within a volcano; a chemical caldron subsequent to a widespread upheaval by subterranean fires," as one writer puts it. "Bodie mountain," in the language of Professor Silliman, who reported on the district, "is an isolated mass of trachytic porphyry, having white crystals of a feldspathic mineral implanted in a lavender colored paste; it is an island of irruptive rocks. The whole surface of the surrounding region is covered with decomposed porphyry, in which are seams, abundantly supplied with fragments of quartz, jasper, chalcedony, and other vein stones derived from the breaking up of the crests of the mineral lodes. The eye experienced in gold bearing drifts recognizes at once, in the aspects of the sides of this mountain, the probability of the existence there of profitable deposits of gold." Silliman thoroughly believed in the existence of one great *mother lode*. Subsequent discoveries tend to substantiate this. A transverse section of Bodie Bluff shows the many veins of ore, spread out like the sticks of an open fan; that is, they all tend to a common center, where they are supposed to meet and unite with the mother vein. This formation extends through the entire district, but no cross cuts have yet been made. A theory entertained by many is that the whole geological formation was riven asunder, and the chasm filled by sedimentary action. Professor William P. Blake, of the Sheffield School of Mining, believes that the structure of the rock indicates that "the veins were deposited gradually in fissures, by thermal springs." Both theories would favor the great depth of the veins. On the surface the veins are hard and sterile of metal; at sufficient depth they become soft, friable, and rich; and deeper still more rich, and so decomposed as to even yield to the shovel. The extent of the mineral ledge is between *two* and *three* miles. It was supposed at first that the general dip of the veins was in a southwesterly direction, but recent developments prove conclusively that they run easterly, and the probabilities amount almost to a certainty that the Dudley and Jupiter claims, on the east side of the ridge, have the same rich ore bodies that maintains in the Syndicate, Standard, and Bodie. In all these leading mines the farther they prospect the more ample and richer become the mineral deposits, tending more and more to prove the "*veta madre*" or mother vein theory. They are down over 400 feet in the Bodie, 520 feet in the Tioga, and over 700 feet in the Standard, but in the latter are temporarily drowned out with water. The Bruce drift in the Bodie has proved immensely rich and increases as it goes southward. In the Standard there is a thousand feet of rich ore laid bare. All these veins are mingled with carbonate of lime, a good indication for permanency. This formation extends clear through to Noonday on the extremest south, with the certainty that the rich veins of the Standard and Bodie bear off to the east, through the east side of Mono. There is every probability that the next bonanza will be opened in Jupiter and Dudley, which are just to the south and east of Bodie and Mono. Good ore is already being taken out, but they are waiting for their pumping machinery, so that they may penetrate to the lower levels below the barren cap rock which covers the district. When this is accomplished these mines will likely prove a *dividend proposition*. A large amount of machinery is being brought into the whole district. The Noonday is erecting a 20 stamp mill. The Standard and Bulwer Companies are jointly putting up a 30 stamp mill; and pumping and hoisting machinery has been ordered for a number of other mines.

There is unquestionably a big future before them all. The gold and silver mineral is not found in pockets, but is disseminated with average yield throughout the length and breadth of all the veins. Resembling the Comstock in many striking particulars, the Bodie bids fair to outrival that veteran district, which has so long dominated the stock market of the Pacific Coast. H. S. W.

San Francisco, August 1, 1879.

A Canal Mowing Machine.

To the Editor of the Scientific American :

I notice in your paper for August 16 an article with the following heading, "A Canal Mowing Machine Wanted," and wish to say that such a machine, and one which is as much superior to the one described in that article as a land mowing machine is to a scythe, has already been invented, and has been in operation every summer for a number of years on the canal of the Connecticut River Company, at Windsor Locks, Conn. It is driven by belting from the engine of a steamer built especially for it, and works well. It will be run a part or the whole of the coming week.

The machine consists of a frame of as near as I can guess 12x8 or 10 feet, with a shaft at the end to be attached to the boat, on which, at about the center, are a tight and a loose pulley, and at each end a disk or crank, with short connecting rods to the side rods running through guides, and connected with the knife bar by small chains over pulleys. I have no time for a detailed description. It can be seen probably at any time, on application to Mr. S. H. Allen, Secretary, Windsor Locks, Conn. I would advise Mr. Fish, of the Erie Canal, to examine this machine. The Windsor Canal is 6 miles long, and is the largest water power in the State of Connecticut. It is also a navigable canal, for which purpose it was built.

J. S. Allen, Engineer.

Windsor Locks, Conn., August 16.

"The Devil's Darning Needle."

To the Editor of the Scientific American :

The statement of Mr. W. M. McGee, in your issue of August 16, to the effect that the thick-legged walking-stick (*Diapheromera femorata*), which I recently treated of in your columns, may sometimes survive the winter, is founded on mistaken identity. It dies with the first severe frost, and passes the winter, as I have shown, in the egg state. Not so with the water boatmen—certain elongate long-legged heteropterous insects (genus *Ranatra*)—which bear a very general resemblance to the walking-sticks, and which were, beyond any doubt, the insects observed by Mr. McGee. Popular terms are variously applied in different parts of the country, but that employed at the head of this communication is most associated in the popular mind with the dragon flies (*Libellulidæ*). Yours respectfully, C. V. Riley.

August 16, 1879.

Turbo Shells and Sea Beans.

On the beach of Little Saba Island (St. Thomas) there was being formed a reddish sandstone conglomerate rock composed of the *débris* of the rock of which the higher parts of the island consist, cemented together by calcareous matter derived from the corals and calcareous sand.

This rock, which was hard and compact, contained embedded in it plenty of the various corals from the beach, and large turbo shells (*T. pica*) with their nacre quite fresh in luster, and their bright greenish color unimpaired.

Large examples of these turbo shells, as much as two inches in diameter at the base, are in St. Thomas, carried up far inland by terrestrial hermit crabs.

I saw a large number of them among the bush at an elevation of 1,000 feet, some of them with the crabs in them, many empty. These large, heavy sea shells occurring in abundance at great heights puzzled geologists, until it was found that they were carried up by the crabs.

On the shore at Little Saba Island grow a number of plants of *Guilandina bonduc*. This plant bears a pod covered with prickles, which contains nearly spherical beans of about the size of a hazel nut, which have a perfectly smooth, as it were, enameled surface, and are flinty hard. These seeds float, and are carried by ocean currents to distant shores, and are in Tristan da Cunha and Bermuda known as "sea beans," and supposed to grow at the bottom of the sea. Don Jose de Canto showed me one found in the Azores.—*Moseley, Notes by a Naturalist.*

We have it on the authority of Dr. Bock, of Leipsic, that the nervousness and peevishness of our times are chiefly attributable to tea and coffee; the digestive organs of confirmed coffee drinkers are in a state of chronic derangement, which reacts on the brain, producing fretful and lachrymose moods. Ladies addicted to strong coffee have a characteristic temper, which might be described as a mania for acting the persecuted saint. Chocolate, he adds, is neutral in its psychic effects, and is really the most harmless of our fashionable drinks.

CUTTING PACKING COMPANY.—ONE OF THE LARGEST ESTABLISHMENTS OF THE KIND IN THE COUNTRY.

Next to mining, the fruit products of the Pacific coast give it celebrity throughout the world. The size, quality, and abundance of these products render them especially suitable for foreign markets, where they are largely shipped in the shape of canned goods, prepared so as to retain their natural flavor, and cheapen their comparative cost to the consumer.

As illustrating this large and growing industry, the Cutting Packing Company, both by merit and reputation, is well worthy of description. The house was established in 1853, on Commercial Street, San Francisco, Cal., under the name of Cutting & Co., and was necessarily very small in its capacity and imperfect in its appointments at that time.

In 1875 it was incorporated as the Cutting Packing Company, and by careful management and a proper spirit of enterprise the development of the business has been constant and reliable, until at the present time its magnitude is enormous and really a monument to the energy that developed it. Besides canning fruits, the concern now can meats, vegetables, honey, preserves, jams, and jellies, and manufacture pickles and cider. The following figures will prove interesting to the readers of the Scientific American, as concisely exhibiting the magnitude of this important industry:

GOODS PREPARED FOR MARKET IN THE YEAR 1878.

900,000	cans fruit	averaging 2½ lb.	each.
475,000	" vegetables	" 2½ "	"
110,000	" meats	" 2½ "	"
285,000	" preserves, jams, and jellies	" 2 "	"
76,000	" strained and comb honey	" 2 "	"
24,000	glass packages honey	" 2 "	"
18,000	" " jams and jellies	" 2 "	"
15,000	" " pickles and sauces	" ½ gal.	"
16,000	wood packages pickles and sauces	" 25 "	"
12,000	quarts champagne cider.		

This product represents the following material used:

FRUITS.

Apples	190 tons.
Apricots	110 "
Blackberries	75 "
Currants	45 "
Cherries	25 "
Gooseberries	20 "
Grapes	60 "
Peaches	325 "
Plums	160 "
Quinces	40 "
Raspberries	12 "
Strawberries	45 "
Pears	210 "
Total	1,317 "

VEGETABLES.

Asparagus	15 tons.
String-beans	45 "
Peas	60 "
Tomatoes	350 "
Pickles	175 "
Corn	25 "
Total	670 "

MEATS.

Beef, boned	220,000 lb.
Mutton, "	90,000 "
Pork, etc., "	12,000 "
Total	322,000 "

MISCELLANEOUS.

Salt	160,000 lb.
Vinegar	72,000 gal.
Sugar	360,000 lb.
Honey	110 tons.

The tin cans for putting up this immense quantity of goods are all manufactured by the concern, and it requires 1,750,000 of these, averaging 2½ lb. each. For their construction 7,500 boxes of tin plate are used, 15 tons of pig lead, and 15 tons of pig tin. The plate tin is imported from England, the pig tin from Australia, and the pig lead is mined on the coast. Sugar is purchased by the car load, and salt by the schooner load. In fact everything is conducted on a wholesale principle, yet the most scrupulous regard is paid to the minutiæ of the business, and each department works in perfect harmony with the others toward the advancement of the whole.

The warehouses and factory are located on Main Street, Nos. 17 to 41, just off from Market Street, the principal street of the city. The extent of the premises is 180 feet on Main Street, and 275 feet deep; stables, cooper and machine shops are attached; the main building for general manufacturing is 90x137 feet, and four stories high.

When I visited this large factory the peach season was at its height, and the capacity of the establishment was taxed to the utmost to dispose of the fine harvest of this abundant product of the State. Stepping on the elevator with one of the proprietors of the house, we were taken up to the fourth floor, where between five and six hundred women were busily engaged at long tables in peeling, pitting, and canning the luscious fruit. The most admirable system prevails here for the dispatch of business, and it requires but a few minutes for fruit that had been harvested the same day in the neighborhood of San Francisco, to be put in proper shape for the consumer in some far off market. An elevated railway runs the length of the room between two rows of tables; this facilitates the transportation of the filled cans to the siruping room, where boiled sirup is poured among the peaches, filling every crevice. They are then soldered up and cooked the necessary time which experience has suggested as best.

The concern manufacture their own sirups from the best "*A*" crushed sugar. They are strained twice to exclude all possible impurities.

I was shown a very neat device for soldering the tops and bottoms of the cans, upon which the concern has a patent. It consists of a simple piece of solder wire, which is cut and bent so as to just fit nicely around the edges of the can. After the wire has been properly dropped into position, the can is placed with the top or bottom, as the case may be, in a close fitting aperture on a hot oven; the wire speedily

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melts into the crevices, forming a thoroughly tight joint all around.

All the jellies, jams, and preserves that the concern manufacture are made from the pure juice of the fruit with the very best sugars. A hydraulic press is used to extract the juice, which is boiled in copper kettles until thoroughly jellied.

The meat used is bought slaughtered. In the boning department, on the second floor, expert hands cut out every particle of bone. It is then taken to the third floor and cooked in large meat vats, and afterward nicely canned.

The champagne cider is manufactured after approved methods; portions of the second and third floors are devoted to this department.

The department for preparing pickles is just across the alley from the main building. Gherkins, peppers, limes, beans, cauliflower, and a variety of others are manufactured. There are six large pickle tanks, with a capacity of 8,000 gallons each. These are filled solid with pickles, which are prepared every fall, and are allowed to stand in the brine from four to six weeks until wanted. In the pickle packing room they are treated with spices and vinegar, and kept in large quantities to be drawn upon. The concern manufacture their own brine and all their wooden packages. The company make a specialty of manufacturing all pickles for family use in pure malt vinegar.

The first floor, or basement, of the main building is largely devoted to the storage of fruit juices, which are hermetically sealed in large cans and placed on racks, to be drawn upon for jellying during the winter. The floor of this basement is thoroughly "scowed," so as to keep out the tide, which in this part of the city rises several feet.

The labeling department occupies a portion of the third floor. All the cans are lacquered to prevent sea damp and moulding. They are then handsomely labeled and packed in boxes, containing one or more dozen, for shipment.

In the rear of this department the glassing of pickles and sauces is done. Each bottle or glass is corked, bladdered, waxed, and capped with foil to be properly hermetically sealed for shipment. The honey used by the concern is the finest the bee ranches of California can furnish. It is simply run into cans and jars, either with or without the comb. Some kinds of sauces and catchups are put up in barrels. There is manufactured however, a very fine Worcestershire sauce which is handsomely bottled. Olives are prepared in the factory both from native growths and imported. Some very fine stuffed peppers are manufactured, besides a variety of other small articles. The premises have ample water privileges, are perfectly neat and clean, and devoid of any bad odor.

The concern owns and operates three large salmon canneries: one is located at Eagle Cliff on the Columbia, one on Eel River, California, and one in Alaska. Besides manufacturing eleven different kinds of preserved meats, eight different kinds of sauces, eleven kinds of jellies, and nine kinds of jams, the concern are agents for many of the best Eastern preparations, as well as all of Burnett's extracts.

During the busy season, from May till November, the business requires the employment of 500 hands on the average, and 150 hands from November till April. The weekly payroll averages from $2,500 to $3,000. Goods are shipped to the East Indies, to China, to Australia, and the coast is supplied. It is an industry as diversified as it is extensive, and it utilizes the products of nature in a semi-tropical climate for the benefit of mankind everywhere. H. S. W.

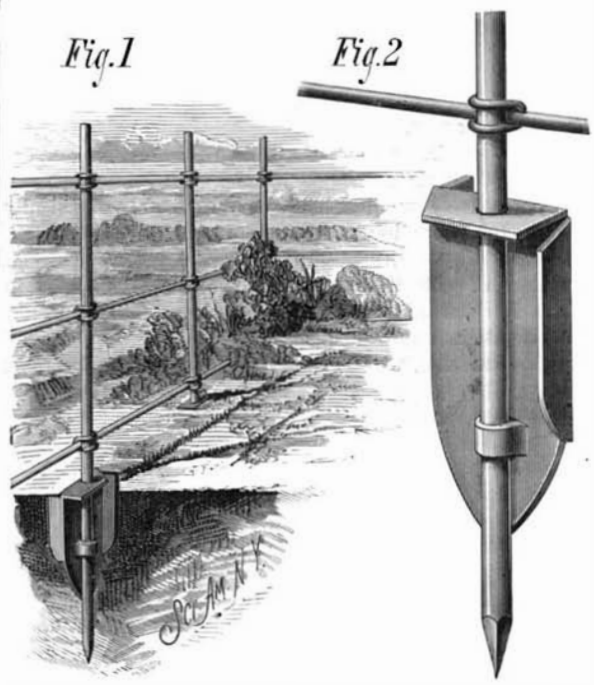
Secretary Evarts on American Industries.

In concluding an official review of the information furnished by American consular agents abroad, with respect to the conditions of trade, wages paid, cost of living, commercial prospects, and so on, in foreign countries, Secretary Evarts says:

"For the first time our manufactures are now assuming international proportions. At a time of universal depression we have met those nations which held a monopoly of the world's markets, met them in their strongholds, and established the fact that American manufactures are second to the manufactures of no other nation, and that, with a proper and patriotic understanding between capitalist and laborer, we can command a fair share of the buying world's patronage, and command that patronage with larger profits to the capitalist and higher wages to the laborer than can be made or paid in any other country. There is something in the Republic which gives an individuality to the people of the United States possessed by no other people to such a degree. Our inventive genius in mechanical appliances is original, and at least 25 years ahead of Europe. Our people accept innovation, are prepared for it by anticipation; Europeans do not. One workman in the United States does as much as two workmen in most of the countries of Europe; even the immigrant from Europe attains this progressive spirit by a few years' association with American workmen. We have no oppressed and stupid peasantry, little more intelligent than the tools they handle. All are self-thinking, self-acting, and self-supporting. Within the last 15 years we have demonstrated our ability, by the brilliant development of our own resources, to exclude, by honest competition, foreign manufactures, to a large extent, from our shores. The question which now peremptorily challenges all thinking minds is how to create a foreign demand for those manufactures which are left after supplying our home demands. We cannot stand still, for the momentum of increase will soon become so great that it will push us outward anyway; to push us safely and profitably is of so much importance as to almost overtop all other public questions of the hour. This question appeals equally to the selfishness and patriotism of all our citizens, but to the laborer it appeals with tenfold force, for without work he cannot live, and unless we can extend the markets for our manufactures he cannot expect steady work, and unless our manufacturers can undersell foreign manufacturers we cannot enlarge our foreign market. The first great truth to be learned by the manufacturers and workingmen is that the days of sudden fortunes and double wages are gone. We must realize the fact that ocean steam communication has annihilated distance and brought the nations face to face. This drawing together of the nations means equalization in trade, profits, wages, etc., the advantage being with those who soonest accept the situation, and show the most sensible continuity in the new paths of success. The Consul at Newcastle-upon-Tyne shows that that city is commercially nearer to New York than to London. If steam communication can thus bring one of the leading cities of a small island like England nearer to New York than to its own capital, it can work equal wonders with the leading seaport cities of all Europe in their commercial intercourse with the seaport cities of the United States. This is a question of great importance to both laborer and capitalist, for it must revolutionize all past theories of trade and commerce, by establishing international equalization. In the near future, the workingman of New York cannot expect twice or thrice the wages of his fellow worker in Europe, while all other things—food, rent, clothing, etc.—are on an equality; nor can the coal miner of Pennsylvania expect twice the wages of the Northumberland miner, while coal from the Northumberland mines can be landed in New York at less than the price of Pennsylvania coal."

NEW IRON FENCE POST.

The engraving shows a novel iron fence post recently patented by Mr. James Carpenter, of New Hope, N. Y. The invention consists in an iron bar forming the post, and a flanged pointed blade that slides over the bar and is driven into the ground to prevent the post from swaying. By looking at Fig. 1 the construction of the post will be readily understood; and Fig. 2 shows a fence built with these posts.



CARPENTER'S IMPROVED FENCE POST.

It is claimed by the inventor that two men can put up and finish 100 rods of this fence in a day, the posts being one rod apart, and three strands of barbed fence wire being used. The cost of this fence, compared with other kinds, is said to be very low.

A Vegetable Curiosity.

A remarkable freak of vegetation has appeared in the grounds of R. B. Tatman, at Worcester, in the shape of a potato vine which bears tomatoes. It appears to be a mixture of the two vegetables, and is accounted for by the fact that a strong tomato vine from chance-sown seed grew in the same hill with the potatoes, and the pollen of the two plants became mixed. Unfortunately the vines were pulled up before the peculiarity of the growth was noticed. Some of our agriculturists may derive a valuable suggestion from this. As both the potato and the tomato are of the solanaceæ family, it is not impossible that one should be fertilized by the other, and a remarkable economy of labor might be effected if careful and scientific cultivation should produce a plant which should bear good potatoes at the roots and good tomatoes on the tops.—*Springfield (Mass.) Union.*

Arsenic in Paper Collars.

Attention having been called by the SCIENTIFIC AMERICAN to the poisonous character of the starch used for some laundry purposes, the paragraph was reproduced and attracted attention in the English papers. The result has been an analysis of certain paper collars and cuffs, by a doctor, at the instance of a patient who showed symptoms of arsenical poisoning. The doctor reports that he has extracted 10·4 grains of arsenic from a single collar.—*Science News.*

The July Product of Petroleum.

According to *Stowell's Petroleum Reporter*, the number of producing wells at the close of July was 11,468, being an increase in July of 245. Total production in July, 1,714,517 bbls. Daily average for the month, 55,307 bbls. The average daily production of each well for the month was 4·9 bbls.

The total shipments of crude, and refined reduced to crude equivalent, by railroad, river, and pipes to the following points, were 1,625,035 barrels

New York took	706,135	bbls.
Pittsburg "	278,030	"
Cleveland "	292,924	"
Philadelphia "	139,968	"
Boston "	85,696	"
Baltimore "	57,187	"
Ohio River refiners took	20,336	"
Other local points "	44,759	"
Total shipments	1,625,035	"

Included in the above shipment there were 212,213 barrels of refined from Titusville and Oil City, which is equal to 318,320 barrels of crude.

The stock in the producing regions has been increased during the month, 89,482 barrels, making the total stock at the close of the month, 7,330,132 barrels, and is held by pipe companies, tankers, and operators.

Retouching Varnish.

A good retouching varnish is a boon to all retouchers, and those who are unfortunate enough to be plagued by too thin films will gladly hail a formula which promises this desideratum. In his recent work on retouching, M. Janssen, the *Photo. Correspondenz* says, recommends the following varnish:

Alcohol (sp. gr. 0·830)	60 parts.
Sandarac	10 "
Camphor	2 "
Venetian turpentine	4 "
Oil of lavender	3 "

This varnish may also be used for paper pictures. The retoucher should not set to work as soon as the negative has been varnished, as the film will not then be hard enough to bear the touch of a lead pencil. The varnished film is in the best condition for retouching when a day old.

GLOSS FOR PHOTOS.

The same gentleman also gives a formula (said to be used by Salomon, of Paris) for a cerate for giving a high gloss to albumenized pictures. The components are:

White wax	800 grammes.
Elemi resin	10 "
Oil of lavender	300 "
Benzoin resin	200 "
Oil of spikenard	15 "

Olives in California.

Recently Mr. Elwood Cooper, of Santa Barbara, California, shipped to San Francisco 1,000 gallons of well clarified olive oil, the product of his orchard at Santa Barbara. According to the San Francisco *Alta*, Mr. Cooper has 6,000 trees, some of them 7 years old, and these produce 20 gallons of berries each on an average in a good year, and one gallon of oil is obtained from seven of berries. Trees 10 years old in a good soil will average 50 gallons of berries in a good year, but sometimes will yield 150 gallons. After a good crop the tree usually takes a year's rest, so that its good years alternate. The whole yield from a mature orchard may be set down at 200 gallons of oil to the acre, and of this 50 gallons may be deducted to pay for gathering the berries and making and marketing the oil.

The *Alta* believes that the olive should receive more attention in California, since it will bear good crops, on poor soil, with less care than any other plant. The hillsides, now worthless, should be covered with olives. The olive requires no irrigation, grows on clayey or rocky soil without much cultivation, and begins to bear in five years, coming to full bearing in ten years.

Rat and Mice Exterminator.

A German newspaper gives the following simple method for exterminating rats and mice, which, it states, has been successfully tried by one Baron Von Backhofen and others for some time past: "A mixture of two parts of well bruised common squills and three parts of finely chopped bacon is made into a stiff mass, with as much meal as may be required, and then baked into small cakes, which are put around for the rats to eat." Several correspondents of the paper write to confirm the experience of the noble baron and his neighbors in the extirpation of rats and mice by this simple remedy.

Transparency of Metals.

With the aid of electricity films of several metals of such minute thickness as to allow the light to pass through them can be produced. An electric current is passed into a wire of one of the metals, that extends into a glass tube containing rarefied air or gases. The particles of metal that the electric current loosens from the wire are deposited on the sides of the tube and form a transparent film. The light that passed through gold was a very handsome green, silver produced blue, copper light green, platina bluish gray, zinc dark bluish gray, and iron brown.—*Chemiker Zeitung.*

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IRON AND WOOD GEAR-DRESSING MACHINE.

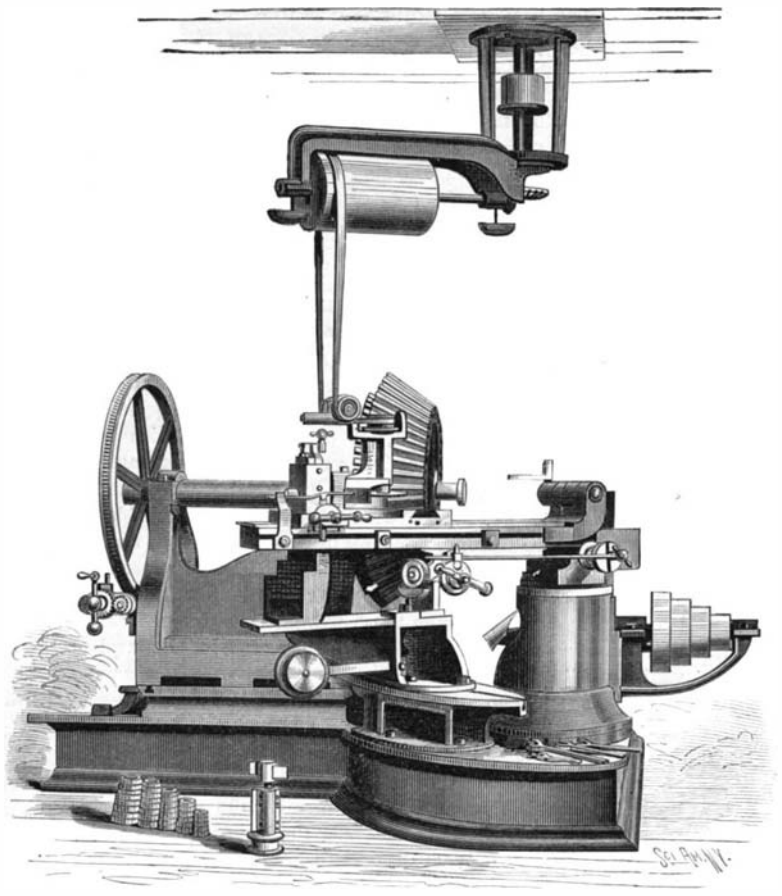
We give herewith an engraving of a novel machine recently patented by Mr. William Gleason, of Rochester, N. Y., for dressing the teeth of iron wheels and for shaping the cogs of wooden gears. The machine may be changed from iron to wood without any delay or change of parts. The gear to be dressed is chucked on the overhanging end of the spindle, the dividing wheel being on the opposite end. The tool holding the slide moves on a bar which may be swung to any required angle for bevels, and power is imparted to the gear-dressing tool by a belt from a drum on an overhead shaft that swings to accommodate the position of the bar that supports the tool slide.

The tool may also be readily adjusted to move parallel with the wheel supporting spindle for dressing spur gears. The bar is jointed both horizontally and vertically, so that it may follow a template or form at or near the outer end of the bar having the shape of the tooth to be dressed. By means of this arrangement the perfect shape of tooth for beveled wheels is secured. For spur gears the form is placed directly under the tool holder.

The movements of the slide carrying the tool are similar to those of a crank planer having a quick return movement. In dressing wooden gears both reciprocating and rotary motions are used, and in place of the ordinary tool, a bracket supporting a spindle and circular saw is carried by the tool holder. A quick rotary motion is communicated to the saw spindle from the overhead shaft by a belt, and the tool holder is reciprocated in the same manner as in dressing iron teeth. The machine does its work perfectly and very rapidly, as the saw cuts on the back stroke as well as on the forward stroke. The face and ends of the teeth may be dressed without rechucking the wheel.

It will be noticed that this machine shapes both wood and iron teeth without the use of expensive rotary cutters, and it has the advantage of making perfect teeth on bevel wheels, a thing impossible with rotary cutters used in the ordinary way.

We understand that this machine is in use in some of the largest shops in the country, giving good satisfaction in every case.

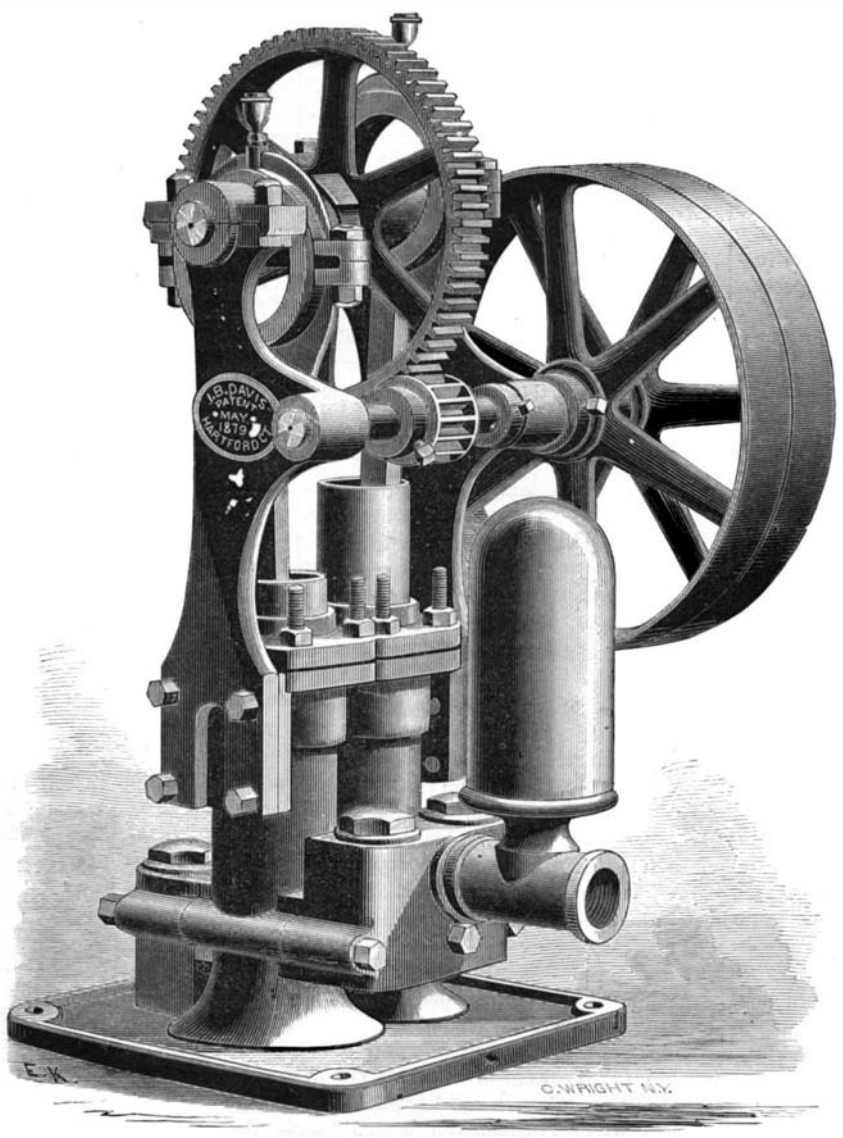


GLEASON'S GEAR DRESSING MACHINE.

IMPROVED BOILER FEED PUMP.

The accompanying cut represents an improved boiler feed pump patented by I. B. Davis, Hartford, Conn., May 29, 1879

It is an established fact that the most economical of all methods of supplying steam boilers with feed water is by the use of a pump driven by a belt, the economy being much greater than is generally supposed. The "Economic" boiler feed pump, as the inventor calls it, is designed to supply a want for a cheap, durable pump, economical in its workings, and not liable to get out of repair. As will be seen by the cut, it is a double pump driven by a single set of gears. All the parts are made very heavy and well finished. The valves, the only part that can wear or get out of order, are made separate and distinct from the pump, and are attached to it by bolts. They can be got at by unscrewing a brass cap, and in case of any accident a duplicate can be put in its place without disturbing any other part of the pump, as they are made interchangeable in all its parts. It is completed ready to run by attaching a water pipe to and from it, and putting on a driving belt. The gear being made from cut iron pattern, and the pump being double acting, make its action much smoother and quieter than other geared pumps. It is especially valuable in sandy water, as the valve can, if worn by the action of the sand, be ground tight in a few minutes by any one. We are informed that its cost is below other pumps of equal capacity. It is made by I. B. Davis, Hartford, Conn., who has offices at 92 and 94 Liberty Street, N. Y., and 43 South 4th street, Philadelphia, managed by H. T. Brewster; and at Boston, 36 and 38 Oliver Street, managed by R. B. Lincoln, Jr.



DAVIS' BOILER FEED PUMP.

The American vs. the British Miller.

A correspondent in the *Miller* (English) berates his countrymen for not being more fully alive to the causes which give the American miller pre eminence over the English miller.

While British millers, he says, are wondering at the ever-increasing importations of American flour, wasting both time and money in discussing various systems, with minds not always open to conviction, Jonathan has discovered a market for his flour under the very nose of the British miller, and has even converted the latter into his salesman.

The writer also refers to our worthy contemporary, the *American Miller*, where, he acknowledges, may be found instructive reading for old-style English millers who will hug their hesitation, deplore foreign competition, and seek for deliverance in every possible way but that of a genuine effort on their part.

"While admitting the serious nature of foreign competition, with strange inconsistency too many British millers cling tenaciously to old methods and machinery, and are wilfully blind to the more improved methods at their command. The equipment of British mills, as a rule, is much inferior to American mills, if we except a few of the largest mills in this country, which are a stride in advance of the latter. The interest in improved machinery here is *superficial* and its adoption *slow*, while the adversary, judging from the paper to which I refer, remodels his mill, improves his flour both in quality and quantity, and no doubt "calculates" on the indecision of the millers here, for some time at least, enabling him to make a small fortune. Ultimately finding us alive to the fact that we have lost ground, and increase our pace, he takes another jump ahead—not so thoughtlessly as may be supposed; on the contrary, his mind is more open to new ideas, and he is ever seeking the way to go ahead, while we pine for a corner in which we can lie down and feel snug. The relative advantages of new over older systems of milling are discussed in a very half-hearted and skeptical spirit by old-style millers; indeed there seems little hope that, without resorting to a surgical operation, some will ever be convinced. Unfortunately there is no recognized system of grading or testing flour, in this country, made under various systems and from certain wheats, both as to quality and quantity. There must, therefore, always be indecision, controversy, and little result, until some test of these systems that can be relied upon is made."

Sawmills Wanted in Brazil.

Mr. Maurice Mauris, the explorer of the Amazon, says that sawmills are much needed in Brazil, and that their establishment could scarcely fail to prove extremely profitable. In many cases, more especially on the Madeira, the current conveys the largest logs of excellent woods, which the sawyer would only have to capture and land. At Serpa, near the mouth of the Madeira, a Portuguese speculator built a sawmill, and the cedar carried down the river supplied his concern in five months with sufficient timber for a whole year's work. So well did his work prosper that this speculator was enabled to retire after a few years independently wealthy, although he had been assisted only by the rudest machinery and unskilled, intractable workmen. Though situated on the confines of a vast forest, Para consumes large quantities of North American timber, only a single sawmill existing in the city. A dozen boards of red cedar (a very common wood) cost about $30 at Santarem.

Useful Hints on Sewerage.

To sewer a town, and then leave house drains to haphazard construction, is simply little better than to waste the ratepayers' money. Comfort and means for health are only to be secured by the best house drainage, and the best house drainage will not be accomplished by builders working under no responsibility. The sewerage of a town or village will consist of waste water and excreta from the houses, and the volume, in round figures, may range from 100 to 250 gallons per day from each house. This volume will probably flow off in about eight hours, so that the sewers must provide for not less than three times this volume, if every drop of roof and surface water can be excluded. As this cannot in all cases be accomplished, the sewers should provide for not less than 1,000 gallons from each house, or, for a town of 1,000 houses (5,500 population), have a delivering capacity of about 1,000,000 gallons. An outlet sewer of two feet diameter, laid with a fall of five feet per mile, will deliver upward of 2,000,000 gallons, flowing a little more than half full; and, as provision should be made for an increase of population, a sewer of two feet diameter may be provided for each 5,500 persons, where no better fall than one in one thousand can be obtained. Lesser diameters will answer where there are no greater falls.

Towns situated on land rising considerably will best be sewered in zones; that is, by intercepting lines of sewers contouring the site, as such sewers will prevent gorging the low-level districts, and also prevent the rush of sewage down steep gradients at high velocities, which, in times of heavy rain, may burst the low-level sewers at the steep gradient junctions. Sewers with steep gradients, if the flow of sewage is unbroken, get up a velocity in the sewage, which is liable to be very injurious in its wearing action on the sewers. Sewage should not be allowed (except when flushing is in operation) to acquire a greater velocity at any state or time of more than six feet per second, as any higher velocity will take grit or other solids along the sewer invert with a cutting and disintegrating action rapidly destructive to the material of the sewer.—*Rawlinson's Suggestions.*

THE largest tree in the Southern States, a tulip bearing poplar tree near Augusta, Ga., is 155 feet high and 9 feet in diameter, its lowest branches being 55 feet from the ground.

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The Missouri Tornado of April 14, 1879.

Dr. J. L. R. Wadsworth and Francis E. Nipher, Secretary of the St. Louis Academy of Science, have made and published a careful study of the tornado which wrecked a portion of Collinsville, Mo., last April. The storm reached St. Louis at 2 P. M. From this point it pursued an even course with the same velocity, reaching Collinsville, 10½ miles east, at 2:35; Lebanon, 21 miles east, at 3; and Highland, 29 miles east, at 3:30 (St. Louis time). It would seem that the necessary elementary conditions for the development of the tornado were found over the American Bottom, and that this development was purely local and did not extend much over ten miles, and had no apparent influence upon the general storm that was passing at a higher altitude to the eastward. The tornado consisted of a principal vortex, of very considerable power, accompanied by six collateral vortices, of much less power, that seemed to possess more than an incidental relationship to the principal; and a second principal vortex apparently independent in time and direction. The direction of the principal vortex was 15° north of east, and, while there was a probable swaying to the one side or the other, the paths of the vortices were in straight lines. The first four collateral vortices were *convergent* upon the path of the principal vortex, and the two last were *divergent*. The principal vortex was in contact with the surface while it was receiving the first four, and had left the surface before it gave off the last two collateral vortices. The height of the principal vortex was about 500 feet; the heights of the collaterals were comparatively small. The rotary spiral motion was in the direction opposed to the movement of the hands of a watch and of great velocity. The progressive motion was about one mile a minute. It had also a vertical or lifting motion, which was often quite abrupt. The path was narrow on the approach to Collinsville—about 100 feet, gradually widening—the vortex at the same time exhibiting less force. At the zinc works it was 600 feet wide. Its lifting power was sufficient to carry large roofs at least 600 feet high; this, with a power equal to the momentum of a body moving sixty miles an hour, would carry heavy *débris* some distance. The effect of these motions was to break up every object the whirl carried up with it; even lumber, taken up free from all contact with anything else, would come down, in many instances, in kindling wood.

In about half an hour after the vortex passed there was a return current from the north, accompanied with severe rain and hail and terrific electrical discharges. There was no thunder and lightning with the vortex, and very little if any rain.

The difficulty in obtaining exact and comprehensive information, from eyewitnesses, of what goes on in a storm of this nature is aptly illustrated by the following incident: A clear-headed and observant citizen of Collinsville, perceiving the approach of the storm, although some blocks distant, ran from a very dangerous position, and found himself only across the street, holding on to a loose stump, when the tornado passed over him. Afterward, while detailing the predicament he was found in, a bystander called attention to a large tree which had just escaped falling upon him. Looking at it for a moment, he quaintly remarked, "I never knew that tree fell there."

A New Weather Theory.

The Rev. Henry Roe, F.R.A.S. (Eng.), sends to the London *Times* a new theory of the weather. He claims to have determined by careful observations, covering nearly thirty years, that dry and wet periods succeed one another in alternate waves of nearly equal length. Not that this equality of duration is quite absolute, or that the wave of one period is exactly the same *facsimile* of that of a corresponding period at an earlier or a later time; but there is enough of regularity and uniformity about the waves to make the family likeness clearly discernible to any eye that looks for it.

These periods extend over three whole years for each, and the following simple rules will enable any one to work out the several cycles of years for himself:

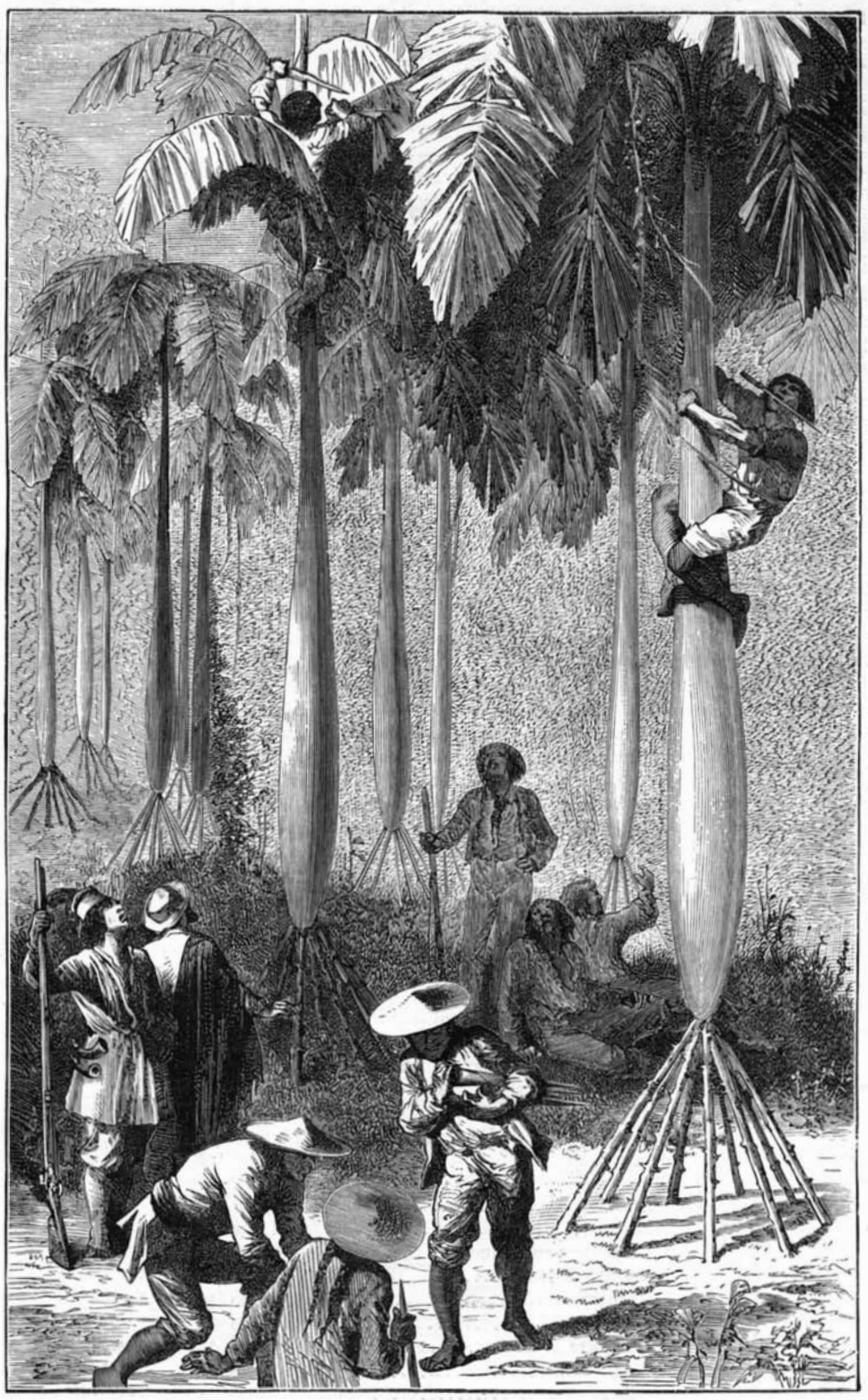
1. When the number representing any given year is even and exactly divisible by three, that year is the middle one of three cold and wet summers.

2. When the number representing the year is odd and divisible by three, then that year is the middle one of a triad of dry and hot summers.

After testing by these rules the successive seasons of the past twenty-seven years, and finding fact to conform to theory, Mr. Roe predicts that 1881 will be the middle one in a triad of hot and dry summers. What relations these dry and wet periods have (if any) to the recognized cycles of sun spots he has not made out; nor does an examination of recent seasons confirm the alleged harmony of theory with fact.

THE SWELLED TRUNK PALM.

The lower part of the trunk of this peculiar palm tree is swelled and supported from seven to nine feet above the ground by a number of radiating and inclined roots. These roots shoot out from the tree during the rainy season, and support it without aid from the main root, which finally disappears. The leaves are from 10 to 14 feet long. This tree is found on the banks of the Amazon. The illustration is copied from *La Vie Végétale*.



THE SWELLED TRUNK PALM.—*Iriartea Ventricosa Mart.*

An Explosion of Starch.

Nearly two years ago a violent explosion occurred in a candy factory in this city, causing the death of thirteen persons. The cause of the explosion was never clearly known, though the evidence pointed strongly to the starch room as the source of the disaster. A similar, but fortunately less fatal, accident occurred in another candy factory in Elm street, August 7, under conditions which leave no doubt that starch dust was the explosive material.

The explosion took place in a drying room on the second floor, where the temperature ranges from 140° to 180°. The drying rooms are 5 feet by 6 and 6 feet by 8 respectively, and are 12 feet high. In each is a furnace kept constantly red hot. The walls are built strongly of brick incased in wood. In the rooms are arranged slides for starch boxes, in which the candies enveloped in powdered starch are placed to dry. The small room has slides for 2,000 boxes, and the large room slides for 3,000. Four men were at work in the drying room taking the candies from the racks. One was on a step-ladder to hand down the trays to the others, who stood around the furnace. He had five trays in his hands. and was about to hand them down when his foot slipped on the step-ladder, the trays fell, and in falling turned over so that a heavy cloud of heated starch dust was thrown against the red hot furnace. The sharp explosion that followed shook the building and filled the room with a sudden flame. The intensely dried woodwork of the drying room caught fire instantly, and the apartment was swept by flames which threatened the entire building. The hands of the factory, however, attacked the flames and extinguished them before any serious damage had been done. The four workmen were severely but not fatally burned.

MECHANICAL INVENTIONS.

An improvement on what is known as the "slow" or bark tanning process has been patented by Mr. George King, of Washington, D. C. Its chief feature consists in alternately subjecting the skins or hides to the action of fresh tanning liquor, then raising them out of it and allowing the liquor to drip or drain off, and, lastly, conducting that portion of the drained liquor which was last in contact with the hides back into the leach to be again passed through the bark, and thus strengthened by taking up an additional quantity of the astringent principle or tanning agent. The apparatus consists of a rotating drum, in whose several compartments the hides are placed, and into which the tanning liquor is constantly fed, and from which it is being constantly withdrawn when its strength has become partly exhausted.

Mr. William H. Watson, of Cheshire, Ohio, has patented an improvement in hay presses which embodies several novel features that cannot be clearly described without an engraving.

Mr. James A. Webster, of South Boston, Va., has patented improved attachments for sawing machines, for converting a sawing machine into a planing machine at a small expense, so that the timber may be sawed or resawed and dressed upon the same machine.

An improvement in the class of wooden axle-skeins provided with a tapering extension for receiving the ends of the axle, has been patented by Mr. Philip Neder, of Stockton, Utah Ter. The improvement consists in hooks, by which the skein is secured to the axle, so as to prevent its endwise movement thereon.

Mr. Joseph V. Morton, of Winchester, Ky., has patented a door fastener that is adjustable to doors of different thicknesses. The invention consists of two handles pivoted to a common connection that extends through the door and connected at the top with a wedge piece that operates the latch. The handle on one side of the door is pushed to open the door; the handle on the other side is pulled.

An improved device for feeding paper to ruling machines has been patented by Mr. John S. Young, of Philadelphia, Pa. It is simple and reliable, and is capable of feeding the paper to the machines one sheet at a time or continuously. It may readily be adjusted to feed thicker or thinner paper, as may be required.

An improved machine for forming dovetailed veneer boxes, so constructed as to form the boxes out of seasoned veneer, has been patented by Mr. David F. Noyes, of Lewiston, Me. The machine, although very simple, cannot be explained without an engraving.

Mr. Harvey Smoot, of Maurertown, Va., has patented a washing machine that is an improvement upon the washing machine constituting the subject of letters patent No. 127,075. In that machine a reciprocating dasher or plunger alternately exerts mechanical pressure on the clothes, and changes their position by the force of the reactive flow of water. The improvement pertains to a trough-like support, receptacle, or holder for the clothes while being soaped, and after having been washed.

Improvements in the buckets of turbine water wheels and the devices for operating the gate ring and governing its movement, have been patented by Mr. Isaac Mallery, of Dryden, N. Y. The object of the invention is to increase the power and durability of the wheel and simplify its construction.

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Farm Wages and the Cost of Living.

The Department of Agriculture has been gathering information in every county in the United States, with regard to the wages paid to farm laborers and the average cost of living, for a chapter in the forthcoming report of the Commissioner.

The returns disclose the fact that in all quarters of the Union (with the exception of Minnesota, California, Colorado, Oregon, New Mexico, and Washington Territory) the average monthly rate of pay for farm laborers declined during the year ending last April from 3 to 15 per cent. At the same time, the expense of living in the majority of States declined in equal or greater proportion, so that the relative condition of the laborer really improved during the year.

The average rate of pay in New England for farm laborers on yearly engagements, without board, averages $20.31 per month, against $22.60 at the beginning of the year, a decline of 10 per cent. The average cost of living has fallen from $9.13 to $8.02 per month, a decline of more than 13 per cent. In the Middle States the conditions were reversed, the ruling monthly pay of the farm laborer being $19.69, a decline of 7 per cent, while the average cost of living had declined only 4 per cent In New York alone farm laborers receive 8¾ per cent less than they did a year earlier, and pay 10 per cent less for their living. The South Atlantic States reduced labor 15 per cent and subsistence 16 per cent, and in the Gulf States labor fell 5 per cent and subsistence only 3 per cent, the average pay in the former being $11 19, and in the latter $14.80 per month In the nine inland States east of the Mississippi, the monthly pay varies from $15.50 per month south of the Ohio, to $20.90 in the north, the rate of decline in wages being a fraction less than that of the cost of living; while in the six States west of the Mississippi the present average pay for farm labor is $23.81 per month, a slight increase over that of a year earlier, and the price of subsistence falls off about 2 per cent.

West of the Mississippi the increase in the rate of wages is chiefly due to the extension of mining operations. In this region a large number of artisans have appropriated public lands and seek to pay for their claims by working a part of the time at their trades. Quite a number of farm laborers have done likewise, and they work part of the time for wages on the farms of others. The large immigration has enlarged the stock of labor, but it is to a great extent somewhat inefficient in character. All who desire work can get it. No surplus is reported from any county in Colorado. In the two Pacific States the average monthly pay of farm laborers is $38.22 against $36.62 one year earlier, an increase of 4⅓ per cent, while the cost of living has increased fully 18 per cent. In New Mexico, Dakota, and Washington Territory there is a demand for skilled and unskilled American labor at remunerative wages. In Utah laborers receive $28.87 per month, a decline of 7 per cent during the year, and a surplus of labor is reported.

In the New England and Middle States there seems to be a surplus of labor in certain localities and a deficiency in others, which should render the average demand about equal to the supply. The general rate of pay for skilled labor—shoemakers, blacksmiths, carpenters, etc.—is slowly rising, and is believed to mark the return of better times for the farm laborers.

A statement of the average rate of wages paid to agricultural labor in several countries in Europe will be of interest as affording a basis of comparison between the condition of the American and the European farm laborer From the tables prepared for the report of Secretary Evarts upon this subject the following information is gathered, the figures referring to the year 1878: Agricultural laborers in England receive, without board or lodging, an average per month of $15.60; in Ireland, $14.73; in Scotland, $19.42; in Normandy, $12.44; in Italy, $15.19, in Spain, $14.95; in France, $13.65.

Wages and Prices in France.

In an official review of the consular reports from France, Secretary Evarts says that "the French working people have, more truly than any other working people, illustrated that commendable phase of political economy—getting the greatest possible result out of the most limited means. They look squarely and sensibly at their capital, and then limit their requirements within that capital; make the most and best of their lot, and fling a halo of sentiment about their lives of toil. For these reasons the work-people of France, with as little remuneration and as scanty fare as those of almost any other country—much less than many of their neighbors—are the happiest and most contented labor population in Europe." Agriculture is the greatest industry of France. There are 10,000,000 land-owners, and 18,000,000 persons are engaged in that pursuit. The weekly wages paid to agricultural laborers throughout the republic are set down as follows: Men, without board or lodging, $3.15; with board and lodging, $1.36; women, without board or lodging, $1.10. Notwithstanding these low wages, it is stated that the French farm laborer not only supports himself and family upon them, but in many cases saves enough to become a landed proprietor. The Consul at Bordeaux writes that "farm laborers are frequently economical to avariciousness, and many of them, in the course of time, become quite wealthy proprietors." The Consul at La Rochelle, where the French peasant still preserves his primitive manners and rural virtues, says: "Upon these wages the agricultural laborer not only supports himself and family, but saves money. The country is free from tramps. The laborer thrown out of employment, yet always willing to work, at once starts out, with his loaf of bread under his arm and his gourd of sour wine swung over his shoulder, confident of finding employment promptly." The Consul at Lyons writes "I regard the condition of the agricultural classes of the United States as much superior to that of those in France, yet from the systematic and economic habits of the farmers of France, as a general rule, the French farmer, small as well as large, is better off than his brother agriculturist in the United States." In many districts in France the laborers supplement their agricultural earnings by secondary employment, such as weaving, wood-cutting, sawing, wooden shoe-making, etc. The Consul at Lyons says that from 8 to 10 per cent of the agricultural laborers in his district are engaged in these secondary employments, which yield to each laborer about $40 per annum. Not only must the husband labor for the support of his family, but the wife and children must also labor for the general fund in order to make ends meet. The married farm laborer, who supports and lodges himself, may earn in the Lyons district $150 per annum, divided as follows: husband's wages, $80; wife's wages, $30; children's wages, $40. The cost of living to such a family, per annum, is calculated as follows:

Rent	$10 50	Milk	$5 25
Bread	55 00	Clothing	25 00
Meat	10 00	Groceries	10 00
Vegetables	8 25	Fuel	8 00
Wine, beer, and cider.	7 00	Taxes	2 00
Total			$141 00

In view of the facts shown by the foregoing figures, viz., that the French farm laborer, when assisted by his wife and children, can earn only $150 per year, while the cost of his living expenses is $141, the Consul at Lyons makes a large demand upon American credulity in asking Americans to believe that "the French farmer, small as well as large, is better off than his brother agriculturist in the United States."

Wages and Prices in Belgium.

The review, by Secretary Evarts, of the consular reports received from Belgium, shows that the working people of that country are happy and contented, notwithstanding their lives are continual struggles for a meager subsistence; that they are frugal and industrious, and live within their means; and that a feeling of reciprocity exists between the employer and the employed. It is thought that this reciprocity of feeling is made necessary in order to enable Belgium to compete with English, French, and German manufacturers in foreign markets, and thus secure employment for their own working men. A few years of misunderstandings between capitalists and laborers, such as periodically convulse England, would paralyze Belgium and ruin both employers and employes. Such is the reciprocity of feeling between capitalist and labor, that manufactories or workshops are scarcely ever closed; the employers, in the dullest of times, preferring to run them even at a loss rather than throw their employes out of work, and the latter, under such circumstances, cheerfully complying with a reduction in hours and wages, cutting down their already bare necessaries of life to tide over the dark hour, confident that when better times return the full time and wages will be again restored. Were it not for this reciprocal feeling which unites labor and capital, Belgium would be scarcely known as a commercial or manufacturing country. The following table will show the weekly wages paid in Belgium, compared with those paid in New York.

	Brussels.	New York.
Bricklayers	$6.00	$12 to $15
Masons	6.00	12 to 18
Carpenters and joiners	5.40	9 to 12
Gas-fitters	5.40	10 to 14
Painters	4.20	10 to 16
Plasterers	5.40	10 to 15
Plumbers	6.00	12 to 18
Blacksmiths	4.40	10 to 14
Bakers	4.40	5 to 8
Cabinet-makers	4.80	9 to 13
Saddlers and harness-makers	4.80	12 to 15
Tinsmiths	4.80	10 to 14
Laborers	3.00	6 to 9

Following are the prices of the necessaries of life:

	Brussels. Per pound. Cents.	New York. Per pound. Cents.
Bread	4 to 5	4½
Beef	16 to 20	8 to 16
Veal	16 to 20	8 to 24
Mutton	16 to 20	9 to 16
Pork	16 to 20	8 to 16
Lard	20	10 to 12
Butter	20 to 50	25 to 32
Cheese	20 to 25	12 to 15
Coffee	30 to 40	20 to 30
Sugar	15 to 20	8 to 10

The consul at Ghent says the rates of wages paid to agricultural laborers are from 17 to 20 cents per day to men, and from 15 to 17 cents per day to women, and their food. When hired as servants, with food and lodging, they are paid $1.75 to $2.00 per month. The consul at Brussels calls attention to the fact that during the years 1874 and 1875 over 12,992,611 francs value of United States gold coin was demonetized and converted at the Mint at Brussels into Belgian coin. How much of our money was thus converted into Belgian money previous to 1874 the consul had no means of knowing; how much, if any, has been so converted since 1875 the consul does not say.

Blushing and Blanching.

Blushing is occasioned by sudden dilatation of the small blood vessels, which form a fine network beneath the skin, and when they admit an increased volume of red blood cause the surface to appear suffused with color. Blanching is the opposite state, in which the vessels contract and squeeze out their blood, so that the skin is seen of its bloodless hue. The change effected in the size of the vessels is brought about by an instantaneous action of the nervous system. This action may be induced by a thought, or, unconsciously, by the operation of impressions producing the phenomenon habitually. In a word, blushing may become a *habit*, and it is then beyond the control of the will, except in so far as the will can generally, if not always, conquer any habit. It is almost always useless, and certainly seldom worth while, to strive to cure a habit of this class *directly*.

The most promising course is to try to establish a new habit, which shall destroy the one it is desired to remedy. For example, if blushing is, as generally happens, associated with *self*-consciousness, we must establish the sway of the will over that part of the nervous system which controls the size of the vessels, by calling up a feeling opposed to *self*-consciousness. It is through the mind these nerves are influenced. Then influence them in a contrary direction by antagonizing the emotion associated with blanching. Thus, if the feeling which causes the blushing be expressible by the thought, "Here am *I* in a false and humiliating position," oppose, or still better, anticipate and prevent, that thought by thinking, "There are *you* daring to pity or feel contempt for another." Avoid going on to think who that "other" is, because the aim must be to eliminate self. Constitute yourself the champion of some one, any one, and everybody, who may be pitied, and the ever-zealous and indignant foe of those who presume to pity. Most persons who blush with self-consciousness blanch with anger, and this artificial state of mock anger will soon blanch the face enough to prevent the blush. It only requires practice in the control of the emotions and the production of particular states at will—the sort of expertness acquired by actors and actresses—to secure control of these surface phenomena. Blushing and blanching are antagonistic states, and may be employed to counteract each other, control of the physical state of the blood-vessels being obtained through the emotions with which they are associated.—*Lancet.*

Practical Co-operation.

A Swiss colony settled on Cumberland Mountain, Tennessee, in 1873. This colony of 115 families, about 700 people, purchased 10,000 acres of mountain land at $1 per acre, and now, after four years each head of a family has a comfortable home, an orchard, and garden with a profusion of mountain flowers. There is a large store that is managed for the colony, members of which get goods at wholesale cost; the colony has its own school, church, doctors, etc., and their own candidates govern. The colonists already have dairies and cheese factories in successful operation, and their products find ready sale at fancy prices. They have splendid herds of cattle, and their barns are built as carefully as their houses. There is also a colony of Swiss near Greenville, S. C., about as large as the Tennessee colony, and it is prospering finely.

A Specific for the Coffee Pest.

A correspondent of the London *Times*, writing from Colombo, Ceylon, announces the discovery of a certain cure for that most destructive pest, *Hemeleia vastatrix*. The discovery was made by the assistant director of the botanical gardens at Colombo, Mr. Morris, and consists in a mixture of sulphur and lime applied in a state of powder to the leaves and branches of the trees. One application suffices to destroy the filaments and spores in a few hours, and it now only remains for planters to resort to this most effectual remedy on an extensive scale, as the materials are to be had in abundance and the cost of application is trifling.

The Adirondack Survey.

Mr. Verplanck Colvin, Superintendent of the Adirondack Survey, began the survey of the Raquette River district at Potsdam, St. Lawrence Co., early in August. Arrangements had been made to occupy an astronomical station at that place, and to set up a substantial monument there recording the exact geographical position. It was proposed also to locate accurately all the important land lines, township corners, etc., in the Raquette River district, and mark them by stone monuments carrying nickel plated copper bolts.

Antiseptic Action of Acids.

According to Sieber a relatively small proportion of acid, 0·5 per cent, prevents putrefaction. This property is conspicuous in the mineral acid, and in acetic acid. Lactic and boric acids are much less effective.—*Journ. Prakt. Chemie.*

MR. FRIEDRICH WEGMANN, of Zurich, has recently patented in Germany the "application in roller mills of rollers whose coating shall consist of a homogeneous mass of porcelain, china, or glass, containing as much silica as shall be requisite to obtain the necessary degree of hardness for the process of grinding."

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Snowballing in July.

A very novel spectacle was witnessed in New York city, last month, at Morrisania, where people were snowballing each other with genuine fresh snow, pressing it into big round balls, pelting each other with it, and slapping their half-frozen fingers on their thighs to restore circulation to the benumbed members. It was, of course, artificial snow, and made by the working of an ice machine just set going in J. & L. F. Kuntz's brewery.

The machinery, as usual in all ice machines of this class, consists of three parts—a compressing pump, a condenser, and a refrigerator. Aqua ammonia of the highest procurable strength, is poured into a small still and heated until the ammoniacal gas is all driven off into the condenser. There, by the compressing pump, it is liquefied, at a pressure of six and a half atmospheres in a temperature of 50° Fah. The liquid gas is passed thence, through small tubing, into the refrigerator, which is a separate close chamber about 14 feet square; this chamber is the freezing box for the whole brewery. The refrigerator itself is a voluminous machine, consisting of eight coils, each 300 feet in length of continuous welded pipe, the whole forming a large cylinder 9½ feet in diameter. In these coils of pipe the gas, liquefied under pressure, reassumes its gaseous form, and in so doing takes up all heat about it. The cylinder is kept whirling swiftly, partly to promote the spread and expansion of the liquid, but more to enable a lot of huge brushes to sweep off constantly the snow which is continually forming from the atmosphere upon these pipes. A cart load of snow is thus swept off every day. But it is not nice snow. It is good enough for snowballs, but there its use stops, for the air from which it has been formed has been sucked up by a powerful draught from the depths of the lowest cellars, and every sour smell or taint in the atmosphere is transferred to this snow. The air driven down to replace that thus drawn up is not only freezingly cold, but is dry and pure, so that through all the vaults the atmosphere seems like that of the country on a winter's morning. After going through this great mass of tubing, the gas returns to the outer chamber, bearing with it all the heat it has taken up; and to get rid of this it is sent through 1,200 feet of piping, upon which water falls in a spray, and a great fan keeps up a constant cooling current of air. After that it is fit to pass into the condenser, and so around again. None is wasted; none escapes. Yet it maintains a temperature of 3° Reaumur (say about 38° Fah.) throughout three vaults, each 80 by 50 feet, with an average height of 11 feet, and even greater cold could readily be obtained were it desirable. The use of this apparatus enables the actual storage at one time of 50,000 barrels of beer.

It is claimed for the invention that it will save brewers a vast sum by diminishing the consumption of ice, and doing away with the necessity of constructing underground vaults of large dimensions.—*Manufacturer and Builder.*

LACE FAN.

The fan shown on this page is of French manufacture. The face is made of the finest lace, the pattern being designed and worked expressly for this purpose. Nothing more delicate and fairy-like could be imagined, nor could the most capricious beauty demand anything more exquisite.

Ozokerite, or Mineral Wax.

We make the following extracts from a letter, which appeared in the *Foxburg Gazette*, written by Mr. E. M. Grant, who has recently returned from a visit to the various oil-fields of Europe:

The production of oil in the Eastern Galicia oil fields is very limited at present in amount. The wells are mostly situated near Boryslaw, though there is one well south of Boryslaw about 45 miles, that is doing 8 to 10 barrels per day of nice green oil.

The wax fields of Eastern Galicia attract the most attention. This earth wax, or ozokerite, as it is called, is neither more nor less than oil that has been evaporated, leaving the residuum in a solid state, so that it is dug out with picks and shovels, and is about the consistency of common clay. It is very valuable, being worth from 7 to 8 cents a pound.

The shafts are from 350 to 600 feet deep and very close together, so close that, on the piece of land where this wax is found at Boryslaw, containing not over fifty acres, there are 10,000 shafts.

The walls of these shafts are curbed with timbers, but at the depth to which they go they are very thin, so that scarcely a day passes but the walls cave in, breaking the timbers like pipe stems, and burying several human beings beneath the great mass of earth. This thing occurs so frequently, that from four to six persons per week are killed in this manner.

Great fortunes have been accumulated by a few of the Jews who owned the land where the wax was found. The vein is about 16 inches thick, and the wax is carried out in buckets. Twelve thousand men live on that fifty acres of land, how, nobody knows. The wax is refined and made into candles. This being a great Catholic country, and a holiday occurring nearly every other day, candles are in great demand. Our party, consisting of Jas. H. Clark, John Huntington, James Carrigan, and Worthy Clark, of Cleveland, and Wm. L. Lay, of Oil City, took breakfast with a Polish gentleman at Boboka, and the conversation turning on earth wax, Mr. Lay said that there was a mountain of it in Utah, at which the old Polish gentleman exclaimed, "My God! the Lord is with America again! He gives Poland sixteen inches of earth wax, but He gave America a whole mountain." They all like America and Americans, most of them being republicans at heart. The wax field is fully developed and nearly exhausted, unless they should find something new.

In Hungary there is no oil of any account being produced, but there are surface shows all along the range of mountains on the Hungarian side, and some day it will be developed. The government will assist any one who really means business and desires to develop the country.

ENGINEERING INVENTIONS.

Mr. Cyrus B. Cook, of Cynthiana, Ky., has invented an improved combined governor and self-adjusting cut-off, which combines the governor and slide valve of an engine so as to cause the governor to automatically adjust the range of movement of the valve, and thus shorten or lengthen the cut-off automatically. The invention consists in connecting the valve and the governor by a hollow rock shaft, having a second central shaft within. The two shafts are coupled for independent movement, and are combined with an adjustable crank mechanism and a trip mechanism, operated directly by the governor, so that the governor sets in operation the trip mechanism, and allows the engine to act through the independent shafts to alter the throw of the valve rod.

EXQUISITE LACE FAN.

An improvement in water works has been patented by Mr. Paul B. Perkins, of Geneseo, Ill. The object of this invention is to supply water for domestic, manufacturing, and other purposes in cities and towns, and at the same time to furnish the requisite quantity of water under any desired pressure for extinguishing fires wherever the distribution pipes may be extended, by means of stationary pumping machinery discharging the water from its supply source into and through an air tight compression storage reservoir that is provided with the necessary pipes, valves, and fire hydrants, all connected with the town or city mains.

Mr. McWilliam F. Margach, of Meadville, Pa., has devised an improved balance valve, the object of which is to relieve the balancing device from contact with the top of the steam chest as soon as the steam is shut off, and to prevent the formation of a vacuum in the cylinder. It consists of a disk placed on top of the slide valve, and encircled by a ring, which, by the pressure of the steam underneath it, is forced up against the under side of the top of the steam chest, so as to shut off from the pressure of the steam the area on the upper side of the valve inclosed by it, but which is adapted to fall back from contact with the top as soon as the steam is shut off.

Messrs. Adam Moessinger and William Heathcote, of Glen Rock, Pa., have patented an improved gate for turbine water wheels. The invention consists in an arrangement of a circular or conical cap with slotted flanges operated by a rack and pinion, the flange covering the upper openings of the water course, and of a slotted cylindrical ring operated by an eccentric, which covers the lower openings of the water course.

An improved rotary valve and seat has been patented by Mr. Edward L. Watkins, of San Antonio, Texas. The invention consists in combining, with a valve seat having four ports, a rotary valve having a curved opening and recess. When the valve is driven at a uniform speed, the steam will be cut off at about half stroke, but, if desired, it may be so geared as to be driven at a variable speed, and arranged to cut off steam at any desired point of the stroke.

An improved oil well packing, having tapering split clamps and sleeves or thimbles fitting over them, for the purpose of holding an elastic packing, has been patented by Messrs Isaac La Foy and Jesse Siglin, of Bradford, Pa.

Hollway's Process.—The Use of Sulphides as Fuel in Metallurgy.

Mr. John Hollway has prepared the following summarized account of his process for the benefit of those who might not have had time or inclination to read the longer and more technical account given in Mr. Hollway's paper read before the Society of Arts, February 12, 1879.

This process has for its object the utilization of the heat generated by the rapid oxidation of certain mineral substances, which have not hitherto been used as sources of heat for smelting operations. The heat thus obtained is employed in the reduction of the furnace charge, which may be composed partly of sulphides and partly of silicious ores. A current of air is forced through molten sulphides, by which means they are very rapidly oxidized. Great heat is thus developed, rendering the process of smelting a self-supporting operation; therefore no extraneous fuel is required, excepting that employed in raising steam for the blowing engines; where, however, water power is available steam can be dispensed with, in which case all the carbonaceous fuel necessary for the operation is a little coke to start the furnaces, which stands in the same relative position to the ores as wood does to coal in the lighting of an ordinary fire.

It is well known that pyritous minerals are readily combustible, but the best means of utilizing the heat producing property of metallic sulphides is not so apparent as would at first sight appear. Of these sulphides only iron pyrites is sufficiently combustible at a low temperature to burn in the open air, the mass being raised to the temperature at which the oxidation takes place solely by the union of sulphur and iron with atmospheric oxygen. In Spain there are numerous deposits of poor cuprous pyrites, and the Rio Tinto and Tharsis Companies annually treat, at their mines, about one million tons for the extraction of copper only, which does not average 2 per cent. The process employed consists essentially in roasting the pyrites in heaps in the open air, dissolving out the copper from the roasted material, and precipitating it from the solution by means of iron. These operations extend over several months, any gold or silver contained in the ore is lost, and the iron and sulphur are also wasted. The sulphur passes into the air as an obnoxious and annoying gas, desolating the country for miles around the works.

From the earliest ages carbon has been considered a necessity in all metallurgical operations. The first reduction of metal by means of carbon forms a connecting link between the age of stone and the commencement of civilized art. It is well known that carbon burns at widely varying temperatures, as, for example, in our bodies, in a common coal fire, or in a furnace. A great deal of thought has been devoted to the subject of economizing carbonaceous fuel, and great advances have been made in this direction; yet the expenditure of coal or coke necessary, say, to melt a given quantity of metal still far exceeds the theoretical limit. The main causes of this discrepancy may be accounted for as follows:

1. Only part of the oxygen of the air passing into a furnace, acts on the material to be burnt.

2. The oxygen is not brought in contact with the combustible matter with sufficient rapidity to obtain the necessary temperature for the operation.

3. Gases pass off hot and unburnt. These are now, however, frequently utilized.

There is one metallurgical operation in which the first two sources of loss are avoided, viz., "Bessemer's," where, by blowing air through molten crude iron a very high temperature is attained by the combustion of small quantities of carbon and silicon contained in the crude iron; this is, however, not the case in the process of puddling, where the oxidation is spread over a considerable period of time, although the same constituents are frequently burnt in similar proportions. But even in the Bessemer process the carbon is only half burned, and a large amount of heat escapes with the carbonic oxide and nitrogen.

When, however, thin streams of air are forced through molten sulphide of iron lying on a tuyere hearth, a high temperature is produced by the perfect combustion which ensues in the midst of the sulphides, and no unburnt gases, excepting nitrogen and sulphur vapor, escape from the surface of the molten mass. The hot nitrogen and sulphurous acid may be caused to act upon iron pyrites and other mineral matter, and when pyrites are thus heated an atom of sulphur held in feeble combination is in great part expelled, and thus is obtained molten protosulphide of iron, which is subsequently burnt by the oxygen of the air driven in at the lower part of the furnace, thereby producing the heat necessary for continuing the operation. The process may be defined as a system of fractional oxidation, in which the numerous constituents of a complex furnace charge can be separated from each other and concentrated in different parts of the apparatus, the heat necessary for the operation being obtained by the combustion of a portion of the less valuable constituents.

The principal ores of all our ordinary heavy metals, except manganese and tin, are sulphides. Iron, although largely occurring in an oxidized form, is abundantly found in combination with sulphur; and bi-sulphide of iron, or iron

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pyrites, is an example of sulphurous and combustible minerals. Associated with the iron and sulphur in iron pyrites are invariably found small quantities of other metals, notably cobalt, nickel, copper, silver, gold, lead, zinc, and arsenic. Of these, zinc is almost as combustible as iron itself, while lead and arsenic readily volatilize as sulphides, and cobalt, nickel, and copper are distinctly less readily oxidizable than iron, while silver and gold do not oxidize under these conditions; hence, in supplying air to such material, the iron is the first of the elements to suffer oxidation, so that if the oxidation be arrested before the whole of the iron has been burnt, the cobalt, nickel, copper, silver, and gold present will be found in the unburnt portion. This principle finds a parallel in the Bessemer process of treating pig iron for the manufacture of steel, where a current of air is caused to bubble up through a bath of molten crude iron; the silicon is first oxidized, and is closely followed and to a great extent accompanied by the carbon, and no large amount of iron suffers oxidation, until the whole of the silicon and carbon have been burnt out of the molten material.

The experiments made at Messrs. Cammell's works, at Penistone, in a Bessemer converter, have proved that by blowing air through molten sulphide of iron, the iron and a portion of the sulphur are oxidized, and if the oxidation is arrested before the combustion of the iron is complete, a heavy matte or regulus is obtained, which contains but a small proportion of the iron of the ore, but practically the whole or the greater part of the copper and other less oxidizable metals. In one of these experiments the molten sulphides were run into the converter from a cupola, in which they had been previously melted, and the temperature was kept up until the operation was discontinued, viz., for a period of ten hours, without the use of any carbonaceous fuel, the heat being entirely derived from the oxidation of the iron and a portion of the sulphur of the lumps of pyrites, which were continuously thrown into the mouth of the converter. A Bessemer converter being unsuited for the collection of the gaseous products, the latter experiments have been made in a series of cupola furnaces belonging to Messrs. John Brown & Company, Limited. These experiments have proved the possibility of obtaining a valuable regulus, a slag nearly free from copper, and a considerable quantity of crude sulphur. M. Pourcel, the well known chemist of the Terrenoire Company, has also made some very interesting experiments, having treated by this method a cupriferous sulphide of antimony containing lead and zinc, using heavy spar and silica as fluxes; he obtained a regulus containing the whole of the copper in the form of sulphide, a slag of light specific gravity, and the lead, zinc, and antimony as two separate sublimates, which were condensed in different parts of the apparatus, owing to the superior volatility of sulphide of lead over the oxides of antimony and zinc. In the experiments at Penistone and at Sheffield a cold blast of air was employed, and the gases which passed from the converter or furnace into the open air, carried away with them a large amount of heat. In practice, however, it would be economical to employ a hot blast, which could be heated by the waste heat from the escaping gases. It is remarkable that the least valuable metals, viz., iron and zinc, generate by their combustion the largest quantities of heat.

The process may be employed for the reduction of even the more volatile metals, for example, Mr A. H. Allen, of Sheffield, has thus obtained metallic antimony simply by the oxidation of sulphide of antimony. It is well known that sulphide of lead reacts upon oxide of lead with the production of metallic lead and sulphurous acid. If, therefore, a limited amount of air is blown into molten sulphide of lead, the oxide thus formed in the lower part of the furnace will, in passing upward, come in contact with the hot sulphide of lead, and metallic lead will result with the evolution of sulphurous acid. The furnace having a quiescent hearth below the tuyeres, the metallic lead will collect there, and can be from time to time withdrawn. A limited amount of air must be employed, because if it is driven in too quickly the sulphide of lead would rapidly distill off. In thus treating argentiferous lead ores the silver (and gold if present) would be found with the first metallic lead reduced. When thus treating galena the furnace should have a basic lining.

The process is peculiarly suitable:

1. For the treatment of metalliferous substances which cannot be advantageously treated by other processes. For the extraction of sulphur by distillation, and simultaneously for the concentration and separation of cobalt, nickel, copper, silver, and gold from minerals in the form of metallic regulus; while lead, zinc, antimony, arsenic, etc., accrue in the sublimates.

2. For the treatment of complex ores, for example, gray antimonial copper ores, such as those experimented upon by M. Pourcel. Ores similar to those worked at the well known Bottino Mines, Seravezza, in the Italian Apennines, which contain thirteen or fourteen heavy metals, including silver and lead, for which latter alone they have been worked for centuries. The blende of lead mines, in Derbyshire termed "muck," usually thrown away by the miners, because the large quantity of lead with which it is associated renders the zinc obtained from it worthless.

3. For the treatment of auriferous and argentiferous pyrites. It is well known that in practice it is not possible to obtain the whole of the gold from pyrites by amalgamation with quicksilver, because the presence of sulphur and arsenic sickens and flours the mercury, whereas by fusion the whole of the silver and gold present is obtained.

4. For the treatment of pyrites containing even only small percentages of cobalt, nickel, and copper, which are thus concentrated into a rich regulus, whereas this result is now only obtained by very tedious processes of alternate roasting and reduction. Such ores containing 10 per cent and even 12 per cent of copper exist in South America and many other parts of the world, but are not at present capable of economic treatment, owing to the difficulty of obtaining a sufficient supply of cheap fuel. The process can also be advantageously applied to the treatment of richer ores of copper such as are at present smelted at Swansea.

5. For the treatment of poor lead ores. If such ores are added to a furnace charge of cuprous pyrites, the silica they contain will be utilized and combine with the resulting oxide of iron to form a slag, the galena will be volatilized and be recovered as a sublimate, while any silver present will enrich the regulus. At present, by a costly process of crushing and washing these ores, the galena is concentrated, although a large proportion is left with the *débris*, and passes with the water into the streams, rendering the existence of fish in such waters impossible. The water power now used for washing the ore could, in many cases, be employed for producing the blast.

When thus treating cupriferous iron pyrites, four products are obtained:

1. A matte or regulus containing from 30 to 50 per cent of copper, any trace of cobalt, nickel, silver, or gold the ore may contain, the rest of it being iron and sulphur; it has a specific gravity of 4½ to 5.

2. A slag consisting of silicate of iron from the resulting oxide of iron combined with the silicious matters contained in the ore and the fluxes added.

3. Sublimed sulphur, more or less mixed with volatile compounds of lead, zinc, and arsenic.

4. Sulphurous gases, consisting mainly of sulphurous acid and nitrogen.

The regulus closely resembles, and will replace, the coarse metal of the Swansea copper process, which is now only obtained at considerable cost of labor, time, and carbonaceous fuel. When, however, sulphides of iron and copper present in the bath are treated continuously by a blast of air a point is at length arrived at when the whole of the iron is oxidized, and the regulus in the bath consists of sub-sulphide of copper. If, now, a limited supply of air is introduced, the copper is reduced to the metallic state with the evolution of sulphurous acid.

The slag obtained in the Penistone experiments was essentially silicate of iron containing about 50 per cent of iron and 29 per cent of silica. It had density of about 3·8 to 4, and was in composition somewhat allied to the copper-smelter's ore furnace slag and to the tap-cinder of the iron puddler. By the addition of the calcareous materials, the specific gravity of the slag is so reduced as to cause it to separate readily from the regulus which collects below it. In one of the later experiments, when lime was used, the proportion of copper lost in the slag was very small. This is, of course, a most important point, for when dealing with ores containing but little copper, the presence of even a small percentage in the slag means the loss of a considerable proportion of the copper present. These slags can be utilized for the manufacture of steel, being practically silicious iron ores free from phosphorus, and their reduction in a blast furnace can be profitably effected, as the proportion of iron present is high as compared with the weight of the material, indeed, it may be possible to reduce them while in a molten state.

By resubliming the crude sulphur it can be freed from all impurities except arsenic, and at the works of Messrs. John Hutchinson & Co., Widnes, this is eliminated by means of polysulphide of calcium.

As a certain proportion of the sulphur of the minerals suffers combustion, the resulting sulphurous gases contain from 14 to 15 per cent of sulphurous acid, and hence the proportion of sulphurous acid to nitrogen is nearly identical with that of the gases produced by roasting pyrites in the kilns employed by vitriol manufacturers, and can, therefore, be used with equal advantage for the production of vitriol in leaden chambers. This appears to be the simplest solution of the great problem how to smelt copper without causing a nuisance to the surrounding neighborhood, although a similar result might be obtained by collecting and liquefying the sulphurous acid.

The more incombustible materials it is found practicable to employ without too great a loss of temperature, the wider will become the application for the process; for there are many ores, including silicates and carbonates, containing metals in the form of oxides, which might be conveniently smelted by mixing them with a sufficient proportion of pyritous ores to effect their reduction; in fact, one of the chief practical questions connected with this process is how far it may be trusted to effect the smelting of ores or furnace charges containing comparatively moderate proportions of sulphides.

It is evident that it will almost entirely obviate the necessity for using carbonaceous fuel, at least as far as the production of a regulus is concerned, and consequently the localities in which smelting operations may be advantageously carried on are thus greatly multiplied. One of its chief merits is that it is equally applicable, with comparatively little extra cost in the working, to very poor and very rich ores, for however small the resulting regulus, it will contain nearly the whole of the cobalt, nickel, copper, silver, and gold present in the furnace charge, while any lead, zinc, antimony, and arsenic will be obtained as sublimates.—*Journal of the Society of Arts.*

Yellow Fever.

Dr. Stanford E. Chaillé, chairman of the Havana Commission, has investigated the facts relative to the prevalence of the disease upon the island of Cuba, and finds that "more than twenty years ago out of thirty-six towns only two insignificant ones were free from it; every seaport town had it." He claims that the first authenticated epidemic occurred in 1761, instead of 1762, and that it has continued endemic in Havana ever since the former period.

From Dr. D. M. Burgess the following facts were obtained by Dr. Chaillé relative to the steamer Niagara:

"The steamer Niagara, of the line of Ward & Co., is a first-class iron passenger steamer, and made her first trip June, 1876. Notwithstanding due cleanliness, etc., she went into New York with yellow fever on board on her fourth trip, about September, 1876, and has had cases on board every season since that time. These facts were obtained from the captain, and are attributed by him and Dr. Burgess to faulty structure and continued infection, which both gentlemen deem remediable. The result of this faulty structure is that some two inches of bilge water cannot be pumped out. Dr. Vanderpoel, of New York, has been notified of the chief facts. Two cases developed upon her last trip from New York prior to her entering the harbor of Havana."

Flour Mixed with Mineral Substances.

The author's method for detecting the tenth of a milligramme of alum, magnesia, chalk, gypsum, arsenious acid, etc., added to 10 grammes of flour, depends on the insolubility of the flour of wheat, rye, barley, etc., in chloroform; on their specific gravity, which is less than that of chloroform, and on the specific gravity of the mineral matters, which exceeds that of chloroform. He takes a perfectly dry glass tube 20 centimeters in height, and 2 to 3 in diameter; 10 grammes of the flour are introduced, the tube is nearly filled with chloroform, corked, and shaken for a minute. It is then let stand in an upright position, and in a cool place for some time. The flour which floats on the surface is removed, the chloroform is decanted off and may serve for new operations, and the deposit is treated with cold distilled water, which dissolves alum. The substances insoluble in water are collected on a filter, dried, weighed, and examined physically and chemically. Mineral salts existing naturally in the flour are not deposited, but remain in the floating layer.—*C. Cailletet.*

American Institute Exhibition.

It will not be the fault of this paper if the coming Exhibition of this Institute should prove to be a chaotic mass of half arranged merchandise on the opening day, September 17, for we have so often given notice of the fact that an exhibition is to be held, and have as repeatedly given notice of the time; nor will it be the fault of the officers of the Institute, for the building is always ready in time, but will, we presume, be the fault of the exhibitor, who, as a general rule, procrastinates and is often many days behind. We should think that an exhibitor would desire that his exhibit should be arranged upon the opening day, and not a week or ten days later. For information address General Superintendent, Room 22, Cooper Union Building, New York.

The Effect of Great Pressure upon Powdered Substances.

Mr. Spring, a member of the Belgian Academy of Science, has made several very interesting experiments on the above subject with the following results, as reported in the *Chemiker Zeitung:*

In a hollow steel bar, the sides of which were $\frac{64}{100}$ of an inch thick, he subjected several powdered substances to a pressure of 20,000 atmospheres (133 tons per square inch). Molten and powdered saltpeter was pressed into a solid hard mass like porcelain. Powdered poplar wood was pressed into a block of much greater hardness than that possessed by the wood itself. The specific weight of the powder was 0·389, and that of the compressed block, 1·328. A powdered grindstone was transformed into a new stone of the same hardness as the original one. The same was the case with chalk.

Uralium, a New Metal.

As far back as 1869 the author discovered this metal in commercial platinum obtained from Russian ores. Next to silver it is the whitest metal known; its malleability is as great as that of the purest platinum, but its ductility is much greater, and it is almost as soft as lead. Its melting point lies near to that of platinum, and it is not volatile. Its specific gravity =20·25, and its molecular volume, like those of osmium, platinum, and palladium, is 6·25. Its atomic weight has been found 187·25. In its chemical properties it is difficult to distinguish from platinum.—*A. Guyard.*

The International Dairy Fair.

At a meeting of the Board of Managers of the International Dairy Fair, August 12, it was resolved to hold the fair during the second and third weeks of December next, at the American Institute Rink. The president, Mr. Thurber, was about to sail for Europe, and was empowered by the association to invite all the agricultural societies of England and the Continent to send butter and cheese to the fair for exhibition and competition with American products. Letters from cattle raisers in various parts of the country encourage the managers of the fair to believe that they will have a much larger number of blooded bulls and cows on exhibition this year than they did last.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The best results are obtained by the Imp. Eureka Turbine Wheel and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N.Y.

Golden Healing Ointment. See adv., page 157.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Patent Reports for sale.—1855 to 1871, 46 vols.; 1874 to 1877, 8 vols.; perfect. J. S. Moody, Saco, Me.

For Steam Launches, Engines, Boilers, and Propeller Wheels, address W. J. Sanderson, 21 Church St., Syracuse, N. Y.

Cut Gears for Models, etc. (list free). Models, working machinery, experimental work, tools, etc., to order. D. Gilbert & Son, 212 Chester St., Philadelphia, Pa.

Steam Yacht for sale. G. F. Shedd, Waltham, Mass.

Wanted.—A first-class Machinist or Millwright familiar with hard wood working machinery; one who has had charge of men preferred. Give age, nativity, and experience. Address, with reference, Cincinnati Cooperage Company, Cincinnati, O.

Notice—To Builders of Stationary and Portable Steam Engines, Machinists' Tools, Sugar Plantation Machinery, Pumps, etc., etc., a situation as superintendent or foreman. Address, for two weeks, P. O. Box 340, Beverly, Mass.

Patent for sale of the easiest, most convenient, and useful Monkey Wrench ever invented. W. D., Box 81, Rockland, Mass.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Magnets, Insulated Wire, etc. Catalogue free. Goodnow & Wightman, 176 Washington St., Boston, Mass.

Inexhaustible Beds of Kaolin or Clay.—Wanted experienced pottery men to take an interest in the white, pink, and yellow kaolin beds. Digging and shipping on cars will cost 50 cents per ton. M. J. Dobschutz, Belleville, Ill., Agent.

Forsaith & Co., Manchester, N. H., & 213 Center St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Eclipse Portable Engine. See illustrated adv., p. 157.

Bradley's cushioned helve hammers. See illus. ad. p. 142.

Band Saws a specialty. F. H. Clement, Rochester, N.Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Yacht Engines. F. C. & A. E. Rowland, N. Haven, Ct.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

New 8½ foot Boring and Turning Mill for sale cheap. A first class tool. Hilles & Jones, Wilmington, Del.

Wanted.—Responsible party to build and introduce Thomas' Patent Steam Wheel. Monopoly to right party. Write for description and particulars, to J. C. Thomas, Carlinville, Ill.

Cooper Manufacturing Company, Mt. Vernon, Ohio, Manuf's of Stationary, Portable, and Traction Engines, Saw Mills, Grist Mills, Mill Machinery, etc. Engineers and Contractors. Circular free.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Rubber Belting, Packing, Hose, and all kinds of manufacturers' supplies. Greene, Tweed & Co., 18 Park Pl., N.Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

Solid and Opening Die Bolt Cutters, Screw Plates, and Taps. The Pratt & Whitney Co., Hartford, Conn.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Having enlarged our capacity to 96 crucibles 100 lb. each, we are prepared to make castings of 4 tons weight. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 78.

Steam and Gas Fitters' Tools a specialty. Send for circulars. D. Saunders' Sons, Yonkers, N. Y.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Walrus Leather, Solid Walrus Wheels; Wood Wheels covered with walrus leather for polishing Greene, Tweed & Co. 18 Park Place, New York.

NEW BOOKS AND PUBLICATIONS.

THE THEORY OF SHIPBUILDING (Theorie des Schiffes). By Victor Lutschaunig. Trieste, Austria: F. H. Schimpff. 1879.

The author of this work is the professor of shipbuilding at the Royal Commercial and Nautical Academy in Trieste, and has arranged the same to conform with the course of lectures he delivers at the above institution. All the formulas and results are computed by means of differential and integral calculus and analytical geometry, and only the theoretical part of shipbuilding has been regarded. The first chapter treats of the formulas, with their derivation, for the calculation of the center of displacement, the immersed section, and the entire displacement of a ship in or out of equilibrium. The second chapter treats of the meta center and the dynamical stability. The succeeding four chapters treat of the waves and their action upon the ship, the oscillations of ships in still water, and the resistance produced by the waves. The seventh and last chapter treats of the strength of the ship and the forces that tend to destroy the same. Formulas for obtaining the moment of inertia for different sections are annexed, and will be found of great use to every scientific shipbuilder.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) J. H. asks for the process of bluing steel without heat. A. Mix finely powdered Prussian blue with rather thin shellac varnish; gently heat the steel, and apply the varnish.

(2) D. H. asks: What chemical difference is there between red and white arsenic? We use considerable red arsenic; the color makes no difference to us; would prefer white, on the score of economy, if the properties were the same as in the red. A. The red arsenic you refer to is probably realgar or orpiment—sulphides of arsenic. White arsenic is arsenious acid and contains no sulphur. They are both poisonous, but in other respects are quite different.

(3) J. P. L. asks how fast it is safe to run a ¼ inch power punch punching iron 3-32 inch thick, or how many holes ought it to punch per minute. A. It will be determined by the rapidity with which you can move and set the plate and clear the punch. Probably 18 to 20 per minute.

(4) J. L. P. asks: How many pounds of resisting air pressure would there be to the square foot, going at the rate of 20 miles an hour, at 30, at 40? A. At 20 miles per hour, 2 lb. per square foot; at 30 miles per hour, 4½ lb. per square foot; at 40 miles per hour, 8 lb. per square foot.

(5) B. G. V. writes: 1. We have a Bell telephone here which we sometimes use in connection with an Edison some eighteen miles distant. There is a continual crackling noise during the whole time they are connected. What is the cause and remedy for it? A. If your telephone line runs parallel with and near a telegraph line the crackling noise is probably due to currents induced by the telegraph line. The remedy will be to use an induction balance, or to shift your line to another set of poles. 2. In the quartz mill at this place there is a large rubber belt running on wooden pulleys, on which there is a large amount of electricity generated. Can it be used to run an electric pen such as described in the SCIENTIFIC AMERICAN? A. No; frictional electricity is not adapted to the propulsion of machinery. 3. Will it answer the purpose of a battery and induction coil? A. It might possibly be used with a voltaic pencil, but it would not replace a battery and induction coil.

(6) W. R. writes: 1. I am to put a pump (the cylinder 2 inches in diameter) into a well 100 feet deep. Which should I use, 1 inch or 1¼ pipe? A. 1¼ inch pipe. 2. Will the additional weight or increase in the size of the column of water make any difference in the working of the pump, provided that it is operated in both cases at the same rate of speed? A. No. 3. Would it be preferable to locate the cylinder in the water (near bottom of well)? A. Locate pump within 16 to 18 feet of the water. 4. In case the larger pipe is used, it is necessary to lift a larger amount of water, and consequently an additional amount of power would necessarily have to be expended in operating the pump? A. No more power required.

(7) T. L. M. asks: How many pounds weight can be raised with a line 1¼ inches in diameter rove through a double and triple block and a snatch? A. For working strain, 1,800 lb. safely; maximum breaking weight, 9,000 lb.

(8) L. F. B. asks if an upright engine should be balanced by the drive wheel so that it will stop with the piston crank in any position. A. Yes, especially if it is run at a high velocity.

(9) D. M. S. writes: 1. I think of building a small steamboat, length 60 feet, 10 feet wide inside of hull, height of cabin about 7 feet at sides. She is to be of sharp build in front. Wish to take several families West in it; and supposing we went up the Missouri River as far as Montana, which would be best: side wheels, stern wheel, or a screw? What size screw propeller should it have? What horse power engine will I need? A. A stern wheel boat, 60 feet by 12 to 14 feet beam, and 3½ feet deep, 2 engines, 8 inch cylinder by 2½ feet stroke. 2. Would it be safe to undertake such a trip with such sized boat as this? A. We think, if properly built, she would be safe for the trip proposed.

(10) W. H. P. writes: I am thinking of building a canoe such as is described by "Paddlefast" in SUPPLEMENT, No. 39, page 618. There are some things about it that I do not understand. 1. Ought the stern post to be perpendicular to the keel (like Fig. 36, page 471, No. 30), or curved like the stern (same fig.)? A. Yes, perpendicular, or nearly so. 2. Would it not be just as well to plank it with ¼ inch cedar as ½ inch? A. ¼ inch thick would spring under every strain and be likely to leak, and it will not hold fastenings so well as ½ inch. 3. Could you beat to windward with full sail (2 sails) and a leeboard? A. Yes, if properly modeled. 4. How fast would the boat probably sail before a fair wind? A. Depends upon spread of sail and force of wind.

(11) W. F. asks which part of a wheel (that is, the outside) turns the fastest when the wheel revolves: if one portion travels through a greater space than another, please state why. A. On the periphery all points have the same speed.

(12) G. M. A. writes: Here, in latitude 40° north, in summer, about June 21, the sun apparently rises in the extreme northeast and sets in extreme northwest, while at noon it is south of us. Please explain. A. The effect is due mainly to the curvature of the earth.

(13) F. J. N. asks how to make a cheap grade of Babbitt metal. A Melt separately 4 lb. copper, 12 lb. tin, 8 lb. regulus of antimony. Pour the antimony into the tin, then mix with the copper, away from the fire, in a separate pot, and add 12 lb. more tin.

(14) F. C. asks how to bleach straw: the process by sulphur, that by chloride of lime and sulphuric acid, also any other processes with which you may be acquainted. Does the straw require any preparation for the before named processes; and if so, what? Among straw bleachers, what is the cheapest and most speedy method of obtaining a satisfactory result? A. Straw goods are bleached by submitting them to the action of the vapor of burning sulphur—or better, to the vapor of burning bisulphide of carbon. The straw, which must be perfectly clean, must be well moistened with pure soft water before submitting to the sulphuric oxide. The bleaching is carried on in tight wooden sheds. Straw may be bleached by chlorinated lime, but the fiber is liable to be somewhat injured thereby. Moisten the goods thoroughly in a strong aqueous solution of the bleaching powder (defecated), and then pass them through a bath of sulphuric acid diluted with about 20 parts of soft water. Repeat if necessary, and finally rinse thoroughly in water containing a small quantity of sulphur or hyposulphite of soda.

(15) J. M. W. asks (1) how sugar is made from corn. A. The starch is separated from the mashed meal by a process of washing. Good corn yields about 25 lb. of starch per bushel of corn. The starch is boiled with dilute sulphuric acid, which gradually converts it into glucose or starch sugar. When the conversion is completed a sufficient quantity of chalk or marble dust is added to neutralize and precipitate the acid, and after defecation and filtration the saccharine liquid is boiled down and crystallized. 2. How much will one hundred lb. of corn make? A. About 45 lb. dry sugar. 3. What is the expense per lb.? A. The cost of manufacture depends somewhat upon the scale on which the business is conducted. Starch sugar is produced at a cost much below that of cane sugar.

(16) Z. C. M. writes: I wish to make a composition for making the ornaments on stove patterns. I have tried camphor, whiting, and sulphate of potash, but did not succeed. I have seen the kind they use, and it smells very strongly of camphor; to use it they simply steam it, and press it into the mould. A. The following composition is commonly used: Soften 12 lb. of good glue in water enough to cover it, then heat until the glue is dissolved. Melt 7 lb. of resin, ½ lb. of pitch, and 2½ pints of linseed oil together. Stir the hot glue solution into this and add enough whiting to thicken. It should be mixed in small quantities and used at once; otherwise it will require steaming before it can be used.

(17) R. M. writes: I would like a book on poisons and their antidotes; can you recommend one? A. You may consult "Horsely on Poisons." 2. What can I put in my water barrels to purify the water? It has to stand a few days stagnant until it is used. I carry it from the hydrant some distance off, and it gets bad in three or four days. A. Try a charcoal filter. 3. Will chickens or domestic fowl eat ordinary poisons, such as strychnine, arsenic, phosphorus, or poisonous acids, mixed with feed? A. Yes.

(18) H. R. L. asks: 1. Can you recommend a standard work on butter and cheese making, and the breeding and selection of profitable stock? A. Willard's "Practical Butter Book," Willard's "Practical Dairy Husbandry," and "Youatt and Martin on Cattle." 2. Can you give an antiseptic to prevent milk from souring within a reasonable time without impairing it for family use? A. The double borate of potassium and sodium has been recommended for this purpose.

(19) C. H. G. asks: What preparation of varnish or shellac will do to put on a celluloid comb and brush which I have painted in water colors? I want something to give a glaze to the decoration, and that will not injure the celluloid, at the same time to make the painting durable and handsome, as the set is a very fine one. A. The ordinary pale amber or picture varnish will doubtless answer your purpose admirably. The "negative varnish" used by photographers may be used instead.

(20) G. W. asks: 1. What form of carbon other than simple powdered charcoal is best for a water filter? A. Crushed willow charcoal, well and recently burned, is preferable. 2. Can a carbon filter be cleaned or renewed without taking apart, that is, by reversing the current of water through it? A. Yes, in a measure, but it is better to renew the charge. 3. How long can iron scraps be used in a filter before requiring renewal? A. The iron should be replaced when it becomes badly oxidized. 4. Does the carbon (animal or vegetable) remove organic matter from water? A. The carbon alone cannot be depended on to remove all of the organic matters, especially if the filtration is permitted to proceed rapidly.

(21) M. H. T. asks: 1. What is the best metal for a pan for galvanizing? A. Cast iron is generally employed. 2. Does a cast iron pan make more dross than a wrought? How would cast steel do? A. The difference is slightly in favor of wrought iron.

(22) R. B. R. asks: Would it be wrong in any way or dangerous to run a lightning rod vertically through the center of a chimney smoke flue, and embed the ground end under bottom of chimney in lieu of running it along the angles of roofs and siding outside? Flue is 30 feet high and 20 inches by 8 inches section. Also, would it, if proper, be necessary to connect stove pipes, registers, or other iron or metal attachments? A. The object of arranging the rod on the roof angles is to afford conduction in case the lightning strikes at the roof. You can safely run the rod down the chimney as you propose, and also connect stove pipes and iron work therewith. But remember that no lightning rod can be considered as a protection unless its bottom end connects with a large extent of conducting material placed underground. For example, if there is a metallic water pipe or gas pipe, connect the bottom of the rod to it by soldered joint. If there are no such pipes, then extend your rod, say fifty feet, underground, in a trench leading away from your house; and carefully embed the rod in coal dust or charcoal, placed in the trench. The deeper you can conveniently make the trench the better. Coal dust, hard or soft, or charcoal, all are good conductors of electricity.

(23) L. K., Jr, writes: The water that we are using to supply the boilers of our engine is very hard and produces a very thick scale of lime which is very hard to remove with a pick. About a day before stopping to clean boilers we have used about one pound of refined catechu by putting it in the heater and pumping it into the boilers with the feed water; it is effectual in loosening all the scale, and there is very little labor in cleaning boilers. Will it be injurious to the iron to continue the use of the same? A. Used in moderation no injury will result. Catechu or cutch is very frequently used for this purpose.

COMMUNICATIONS RECEIVED.

What is Light? By Dr. G.

Boiler Explosion. By A. O. G.

On the Steam Engine. By J. N. W S. D.

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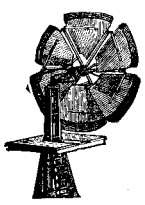

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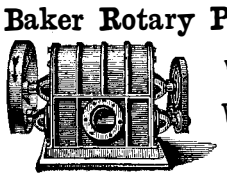

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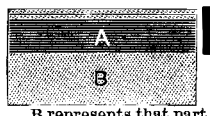

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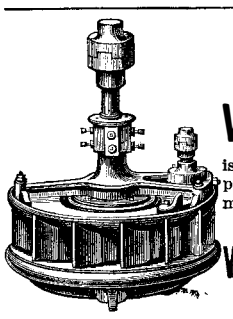

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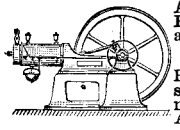

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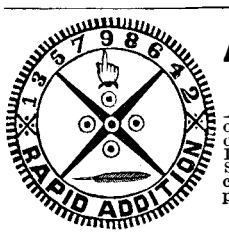

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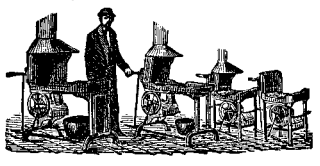

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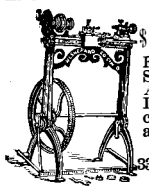

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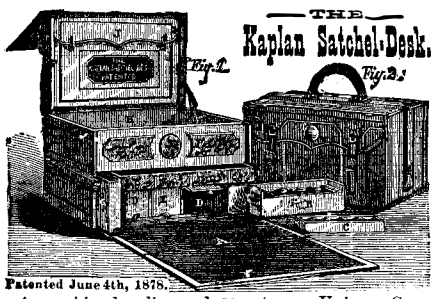

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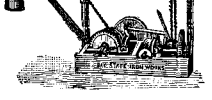

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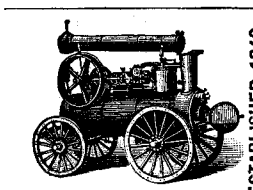

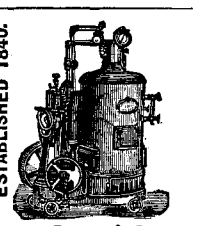

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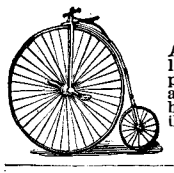

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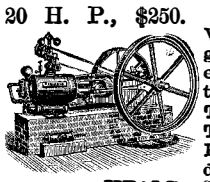

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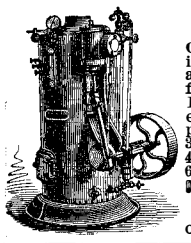

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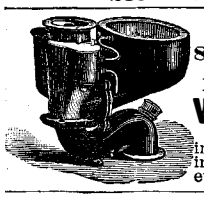

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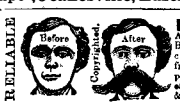

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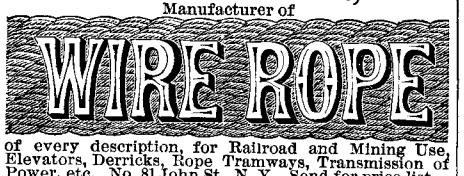

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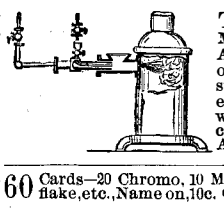

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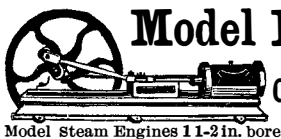

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